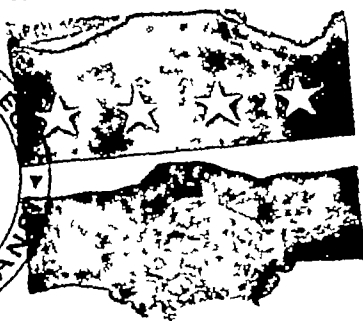


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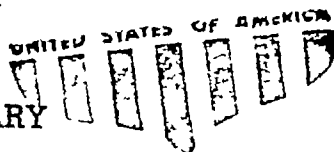
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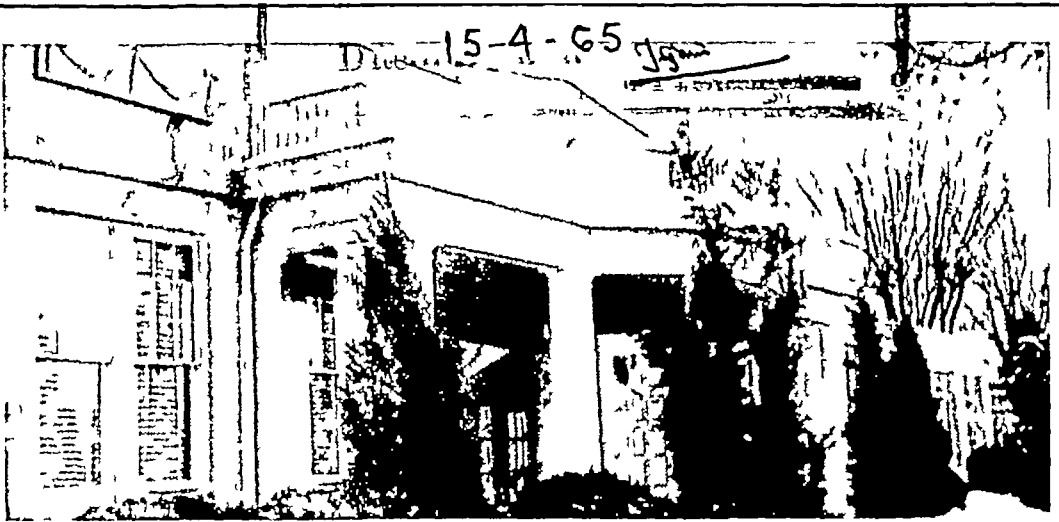
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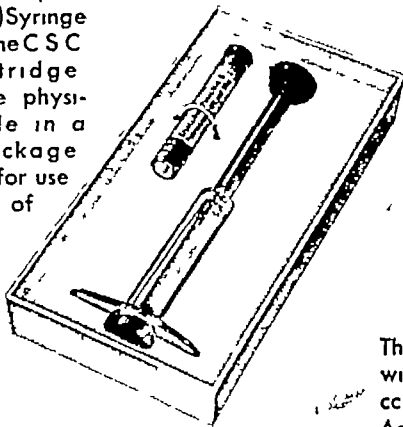
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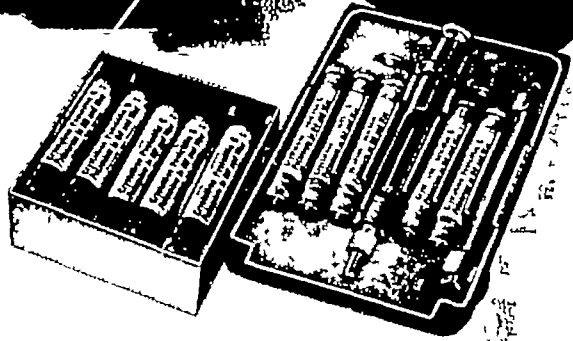
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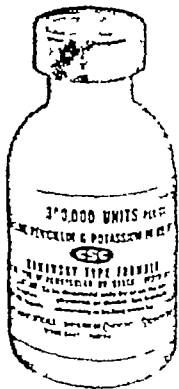
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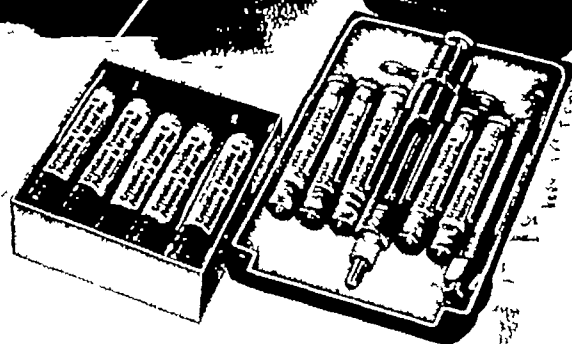
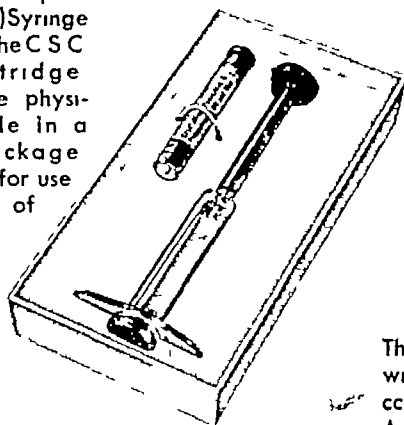
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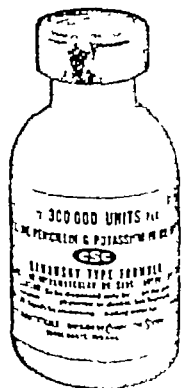
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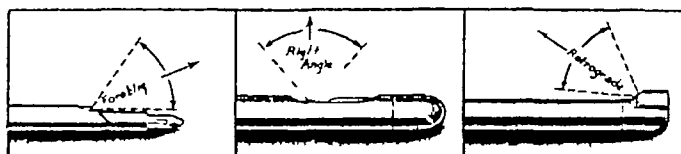
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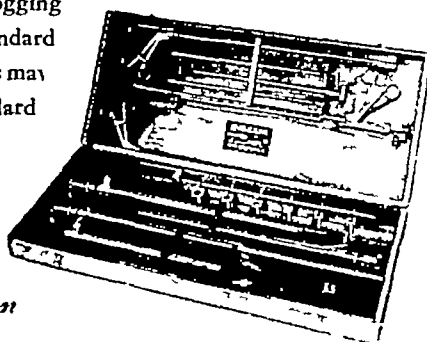
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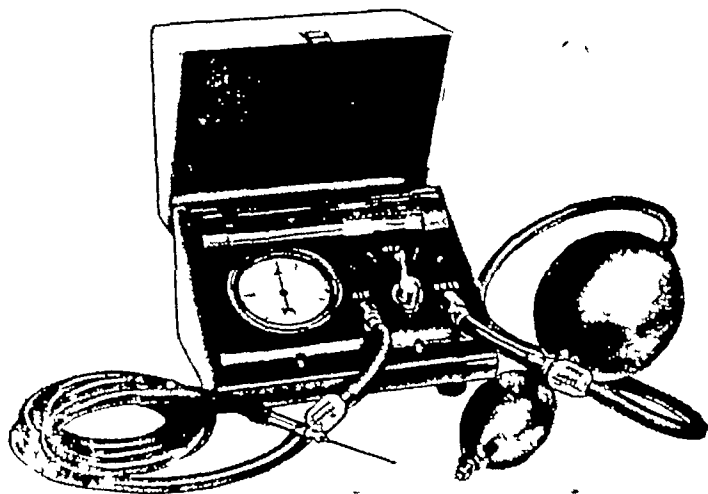
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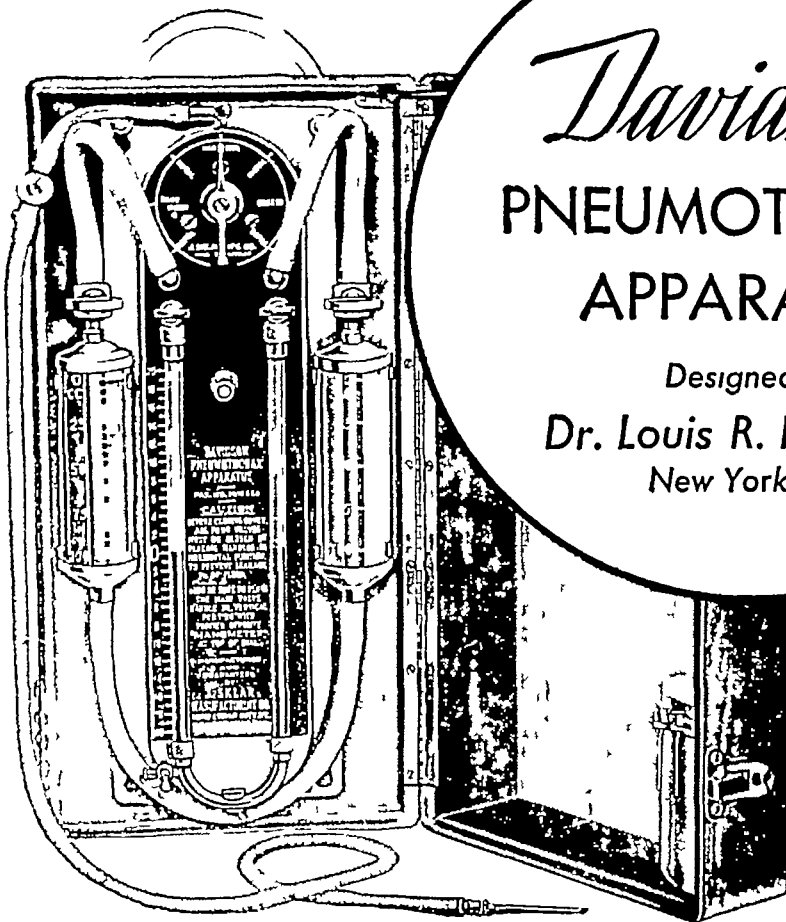
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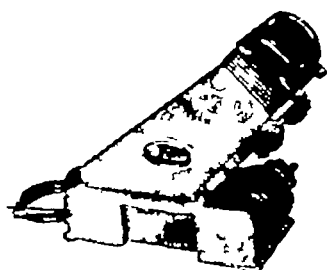
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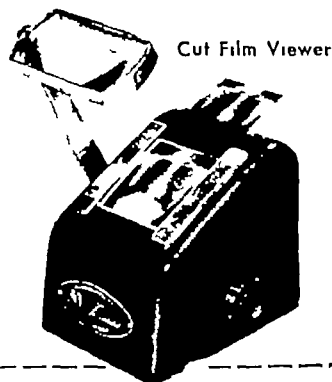
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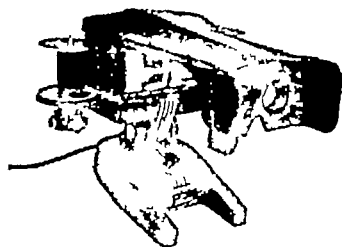
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Tuberculosis of Trachea and Major Bronchi*

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Although tuberculosis of the trachea and bronchi has been known for many years as a complication of pulmonary tuberculosis, its importance with regard to the symptoms, diagnosis, prognosis and treatment of the pulmonary lesion has only been realized within the last decade. Perhaps no one factor has been so important in bringing about this change as bronchoscopy. With the increase in the use of the bronchoscope, many hitherto unsuspected cases of tracheobronchial tuberculosis have been discovered in patients previously thought to have only pulmonary tuberculosis. Notwithstanding the importance of bronchoscopy, it has been necessary to resort to post mortem examination to determine the large incidence of these complications.

We know from clinical reports, based principally on bronchoscopic examinations, that tuberculous tracheobronchitis can change the course of pulmonary tuberculosis from slight to grave and many times fatal symptoms (Bugher, Littig and Culp,¹ Hawkins,² Myerson,^{3,4} Samson,^{5,6} Barnwell, Littig and Culp,⁷ Cohen and Wessler,⁸ Jenks,⁹ Salkin, Cadden and Edson,¹⁰ Dighiero,¹¹ and many others.)

Tracheobronchial disease explains the symptoms of clinical obstruction (wheezing, ronchi, asthmatoïd attacks, capricious elevations of temperature, changing amount of expectoration, cyanosis, and sudden atelectasis. Jackson,¹² has illustrated the mechanism of stenosis by beautiful color plates. Also this complication accounts

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for the persistent positive sputum and the sudden bronchogenic spread which is observed sometimes in cases apparently arrested or in cases receiving pneumothorax. Probably the most important symptoms of bronchial lesion are related to bronchial stenosis and, consequently, to the disturbed passage of air in the bronchus (Tuttle, O'Brien, Day and Phillips,¹³ Eloesser,¹⁴ Allison,¹⁵ Brantigan, Hoffman and Proctor,¹⁶ etc.) In fact, stenosis seems to be the physio-pathological reason for the emphysema and atelectasis, which have a variable evolution and distribution and which hold an important place in the diagnosis. Bronchial stenosis is particularly important in the evolution of the pulmonary cavities and also determines whether or not cavity closure or cavity distension follows, as has been shown by Coryllos,¹⁷ Pagel and Simmonds,¹⁸ Shipman¹⁹ and others.

The development of tracheobronchial tuberculosis is a serious complication which always causes a worse prognosis, especially if stenosis results. Available statistics gathered by Tuttle and associates¹³ show that 32.6 per cent of the recorded cases of bronchial stenosis proved fatal. It was reasonable to assume, therefore, that only two-thirds of the ulcero-stenotic bronchial tuberculosis has a chance to improve.

Likewise, treatment of the disease has been made more difficult and hazardous because of tuberculous tracheobronchitis. Rest treatment alone does not often relieve the condition and collapse therapy is sometimes dangerous. Authors are not wholly in agreement concerning the use of collapse therapy, especially the particular form of collapse. The consensus of opinion is that pneumothorax is detrimental and that thoracoplasty generally gives good results (Alexander, Sommer, Trenton and Ehler,²⁰ Tuttle, et al.,¹³ Samson,^{5,6} Chamberlain and Gordon,²¹ Rafferty and Shields,²² Eloesser,¹⁴ however, was not so sure that thoracoplasty is of great benefit).

Among the numerous reports on this subject, McIndoe, Steele, Sampson, Anderson and Leslie²³ were perhaps the first to make a systematic bronchoscopic examination of non-selected cases of pulmonary tuberculosis. In 272 routine admissions they found 11 per cent of tracheobronchial tuberculosis—a figure that has been approached by nearly all subsequent reports on unselected cases of tuberculosis (Salkin, Cadden and Edson,¹⁰ McCullough,²⁴ Wilson,²⁵ and others). Sharp and Gorham²⁶ in 53 cases studied in the same way, however, described 37 per cent of positive findings. Acuña²⁷ reported 29.7 per cent of the complication in 279 bronchoscopic examinations. Other reports also give higher figures, but it is probable that most figures over 15 per cent include cases selected because of some suspicious clinical signs.

Regarding the pathological aspect of the subject, Louis²⁸ was one of the first to describe the pathology of the condition. He reported 20.3 per cent tuberculous involvement of the trachea—a figure not greatly different from recent reports. Eppinger²⁹ in 1880 reported 8 per cent tracheobronchitis in cases free from laryngitis. Since about two-thirds of cases have laryngitis, the actual incidence in his cases would be around 25 per cent. Cornet³⁰ in 1904 described a pathological classification. The first extensive study devoted completely to tuberculosis of the bronchial tree was conducted by Habershon³¹ in 1905, who reported that in 1255 autopsies, 10.4 per cent had tracheal tuberculosis.

Minkovsky³² reported in 1929 a study of 2379 autopsies and found 11.48 per cent of tracheal tuberculosis in the gross examination. He distinguishes two types, a productive and an exudative, and admits the possibility of infection of the trachea by different ways (hematogenous, lymphatic and by implantation).

Reichke and Frost,³³ in a small series, attempted to explain a new pathogenetic theory. They observed that many of the early lesions were located in the mucous glands which connect the adventitia with the mucosa. As a result, they postulated that the infection passes to the mucosa from the peribronchial lymphatics through the lymph nodes. They noticed in some cases that the drainage bronchus of tuberculous cavities has no tuberculous lesions even in places very close to the cavity. The authors contend that pathogenesis by implantation is thereby disproved. Ornstein and Epstein³⁴ reported eight cases of bronchial tuberculosis with no important tuberculous lung lesion. The latter authors feel that the finding supports the Reichle and Frost theory.

Bugher, Littig and Culp¹ studied both microscopically and macroscopically the respiratory tree from the larynx to the major bronchi in 122 cases of pulmonary tuberculosis, 25 of which were miliary. In 20.5 per cent tracheal tuberculosis, 33.6 per cent bronchial, and 30.4 per cent laryngeal tuberculosis was found. In 76 per cent of the tracheobronchial cases there was also laryngeal tuberculosis, but they claim that the laryngeal lesion is not secondary to the tracheal lesion. Tracheobronchial tuberculosis alone was present in 41.1 per cent of the cases. Since there were 25 cases of miliary tuberculosis, 21 of which were negative for tracheobronchial lesion, it would raise the figure for tuberculous tracheobronchitis in non-miliary cases to almost 50 per cent. Microscopically they described the early lesions as sub-mucous tubercles related to the glands or their ducts. Caseation of these tubercles leads to ulceration. They think that infection results from implantation in the larynx, trachea and main bronchi.

Auerbach³⁵ gave an excellent description of bronchial tubercu-

losis but reported only 4.4 per cent positive findings. He described isolated miliary tuberculosis, ulcerative forms and caseous bronchitis. Flance and Wheeler³⁶ studied the respiratory tree from the trachea to the third order of bronchi in 285 cases of pulmonary tuberculosis and found only 3.1 per cent of local lesions.

Among the more recent works on the pathology of tracheobronchial tuberculosis, Perez³⁷ studied grossly and microscopically most of the respiratory tree in ten cases of far advanced pulmonary tuberculosis. In nine of them he found a tuberculosis lesion somewhere in the trachea and the bronchi. Heafs³⁸ reported 44 per cent of tracheal tuberculosis in 133 autopsies.

Wilbur,³⁹ in an exhaustive study, described 35.4 per cent of tuberculous tracheobronchitis in 500 autopsies, usually located in the postero-lateral wall of the lower portion of the trachea and the adjacent portions of the major bronchi. The author described the early lesions related with the glands as productive tubercles which may develop caseation and form granulatory ulcers. She reasons with admirable logic that the pathogenic mechanism is most frequent by implantation, with the exception of the perforation of lymph nodes in the trachea or bronchi and of the cases of tuberculous tracheobronchitis in the middle of the caseous foci. Meissner⁴⁰ reported 52 per cent positive tuberculous tracheobronchitis in 60 specimens of lungs removed by lobectomy. Chia-ssu

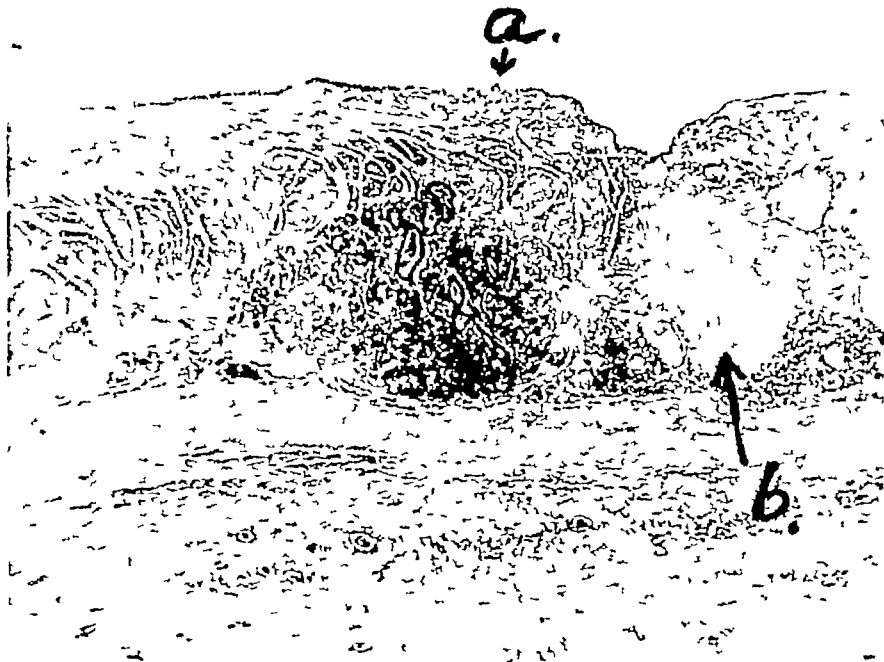


FIGURE 1

A low power microphotograph of the wall of a bronchus showing a superficial ulcer at "a" and gland tubercle at "b" H & E $\times 20$

Huang⁴¹ reported 42.7 per cent tuberculous tracheobronchitis and 50.4 per cent if laryngitis were included on 115 autopsies

Material

Our report involves the analysis of 667 autopsy specimens of pulmonary tuberculosis cases in which the trachea and the main bronchi were systematically studied

General Incidence

As a result, 377 (56.5 per cent) cases of tuberculous tracheobronchitis were found on gross examination. About half of these positive cases (185 specimens) and a fair sample of the negative cases of the trachea and bronchi, were examined microscopically.

In the cases studied microscopically, four sections were taken, one each from the upper and lower trachea, and one each from each main bronchus. The sections were generally taken through regions showing pathological changes. It must be stated, however, that the negative cases were not as thoroughly studied by microscopical section as were the positive cases. Of the 290 negative cases only 32 were examined microscopically, 12 (37.5 per cent) of which were found to be tuberculous. It is clear, therefore, that microscopic search will increase considerably the true tuberculosis incidence, notwithstanding the fact that many of the cases are of little or no consequence. As a result, an estimated figure of tracheobronchial tuberculosis was increased to 486 cases, or 72.9 per cent of the total. Should complete serial sections of the trachea and bronchi be made, even higher figures would possibly be found. Our statistics, therefore, tend to agree with Perez³⁷ figures which indicate that in far advanced pulmonary tuberculosis most cases have tuberculosis somewhere in the tracheobronchial tree. In spite of the fact that many of these minimal lesions have no clinical significance, they do prove the extraordinarily widespread of the tuberculous infection in the passages leading out from the lungs.

GENERAL INCIDENCE OF GROSS LESIONS

TABLE I
Sex Incidence

	Males	Females	TOTAL
Positive tuberculous tracheobronchitis	170 (47.4%)	207 (67.9%)	377
Negative tuberculous tracheobronchitis	189 (52.6%)	101 (32.1%)	290
TOTAL	359	308	667

Sex Incidence (Table I)

Females were found to have a higher incidence of tracheo-bronchial tuberculosis than males, 67.9 per cent of which were positive, while only 47.4 per cent were positive in males. The difference in sex incidence may be related, partly at least, to the higher morbidity and mortality of young females.

Age Incidence (Table II)

The study by age groups demonstrates that the incidence of tracheobronchial tuberculosis decreases progressively with age in such a way that the incidence over 60 years is almost half that of the 11-20 age group (31.25 per cent and 61.05 per cent, respectively). The greatest decrease, however, occurs rather abruptly after 40 years. The higher incidence of these lesions on younger groups might be explained by the more exudative character of



FIGURE 2

A moderately high power microphotograph of a sub-mucous gland duct showing early caseous tubercles and giant cells. Most deep ulcers probably originate in this manner.

H & E x 50

the disease and a probable tendency of the pulmonary tuberculosis to become more generalized in the younger age groups

Incidence in the Various Stages of the Disease (Table III)

The proportion of positive cases in far advanced, moderately advanced and minimal pulmonary tuberculosis in the series studied are not statistically significant, because there were so few cases in the latter two groups. It is more important to emphasize that 87.85 per cent of the cases studied were far advanced disease and that the extent of parenchymal disease logically might be expected to parallel the extent of involvement in the trachea and bronchi.

The Relation of Tuberculous Tracheobronchitis to Cavitation (Table IV)

The incidence of tracheobronchial tuberculosis as related to the existence of tuberculous cavities in the lung, indicates no important difference between the cavitary and non-cavitary cases. Here

TABLE II
Age Incidence

	0-10 Years	11-20 Years	21-30 Years	31-40 Years
Positive Cases	5 (62.5%)	58 (61.1%)	150 (63.8%)	90 (58.4%)
Negative Cases	3 (37.5%)	37 (38.9%)	85 (36.2%)	64 (41.6%)

(Age Incidence, continued)

	41-50 Years	51-60 Years	60 or more	TOTAL
Positive Cases	48 (45.7%)	18 (33.3%)	5 (31.3%)	374
Negative Cases	57 (54.3%)	36 (66.7%)	11 (68.7%)	293

TABLE III

Relation of the Stage of the Disease to Tracheobronchial Tuberculosis

Stage of Disease	Far Advanced	Moderately Advanced	Minimal	TOTAL
Positive tuberculous tracheobronchitis	340 (58.0%)	35 (50.6%)	6 (50%)	381
Negative tuberculous tracheobronchitis	246 (42.0%)	34 (49.4%)	6 (50%)	286
TOTAL	586	69	12	667
Per cent of all cases	87.5%	10.7%	1.8%	667

again the group of cases with no cavitation is too small because over 90 per cent of all cases have one or more cavities. Finally, the existence of bilateral or unilateral cavities and the fact that the cavities are located in the right or left lung does not seem to have any statistical importance in the origin of the tracheal localization. On the other hand, in the small group of cases having unilateral cavernous pulmonary tuberculosis and unilateral bronchial tuberculosis, it is quite evident that in 85 per cent of the cases the bronchial lesion is homolateral to the lung lesion, showing a close relationship between the two processes.

Location of the Lesions Along the Bronchial Tree (Table V)

There was a diffuse spread throughout the trachea and main bronchi in 64.7 per cent of the cases. Most of the localized lesions were found in the lower segment of the trachea and in the adjoining portion of the main bronchi. When the bronchial lesion was unilateral, usually the affected bronchus was on the same side as the more advanced pulmonary tuberculosis.

TABLE IV
*Relation of Number and Location of Cavities
to Tuberculous Tracheobronchitis*

Positive tuberculous tracheobronchitis

No Cavitation	Total Cavernous Cases	Bilateral Cavities	Right Cavities	Left Cavities
26 (55.3%)	351 (56.6%)	234 (59.2%)	55 (57.3%)	62 (55.4%)

Negative tuberculous tracheobronchitis

No Cavitation	Total Cavernous Cases	Bilateral Cavities	Right Cavities	Left Cavities
21 (44.7%)	269 (43.4%)	178 (40.8%)	41 (42.7%)	50 (44.6%)

TABLE V
Distribution of Gross Lesions

Generalized distribution		242 (64.7%)
Lesions in lower portions of the trachea and adjacent portions of the main bronchi		65 (17.3%)
Trachea and left bronchus		19 (5.0%)
Trachea and right bronchus		9 (2.4%)
Trachea alone		31 (8.2%)
throughout trachea	17	
upper trachea	6	
lower trachea	8	
Bronchi alone		11 (2.9%)
left bronchus	10	
right bronchus	0	
both bronchi	1	

In Wilber's³⁹ report a table is presented revealing a wide divergence of opinion regarding the antero-lateral position of the lesions with many favoring the posterior and posterior-lateral walls as points of predilection for the location of the lesions. Although in our series more ulceration was found in the posterior than anterior half of tree, the difference was not strikingly great. There were many isolated antero-lateral ulcers. Lesions located in the bronchi alone are much less frequent (2.9 per cent) and the tracheal involvement alone was only present in 8.2 per cent of the positive cases. But, if localized, they may be found as frequently in the upper half as in the lower. The other combinations are presented in the tables.

Degree of Involvement (Table VI)

In an attempt to classify the various lesions according to the extent of involvement, we divided the lesions into "far" and "moderately advanced," and "minimal." The far advanced cases were those in which there was a wide spread extension of the ulceration through the mucosa (many through the adventitial layer, with some perforations). Minimal cases with those having few and small superficial ulcers. The moderately advanced cases were all the rest. According to this classification there were 37.4 per cent far advanced, 44.6 per cent moderately advanced, with only 18.0 per cent minimal. These figures do not include the grossly negative cases where a microscopic study on a small sample revealed tuberculosis pathology in 37.5 per cent of the samples studied. In the gross lesions alone, 72 per cent were rather well or far advanced.

Character of Involvement

In only a few cases did the tracheobronchial tuberculosis consist of an infiltrative lesion without ulceration where a thickened, granulous mucosa was found. Most of tuberculosis of the trachea and bronchi consisted of ulcerations which were variable in nature and extent. The most common ulceration observed was 1-2 mm in size, with irregular and thin edges, oval or irregular in shape. The base consisted of a granular surface, sometimes covered by a

TABLE VI

The Extent of Involvement of Gross Tracheobronchial Tuberculosis

"Far advanced"	141 (37.4%)
"Moderately advanced"	168 (44.6%)
"Minimal"	68 (18.4%)
TOTAL	377

grayish exudation. There was a wide variety of ulcerations, however, ranging from the superficial miliary ulcers to giant confluent ulcers with deep erosions of a caseous nature or deep erosions with grayish red granulomatous floor and overhanging edges. On the other hand, there are ulcers which have a more fibrous appearance. In a few cases there were fibrous scars which indicate a healed ulcer. The majority of the lesions are confined to the mucous layer, with a less number to the submucosa, and with only a small percentage extending to the adventitious layer.

Caseous Bronchitis (Table VII)

Four cases had the type of a caseous bronchitis, wherein extensive caseous lesions had extended throughout the mucosa and submucosa along large segments of the bronchus.

Fibrous Stenosis

Excluding the cases in which the inflammatory lesion had produced a narrowing of the bronchi, we observed five typical cases of fibrous stenosis, most of them with ulcerative lesions in the



FIGURE 3 A primary tuberculous tracheo-bronchitis of the left main bronchus and the lower part of the trachea. The acute phase has passed, but the effects of obstruction may be seen in the bronchiectatic cavities out in the lung and the stricture of the trachea.

TABLE VII

Coexistence of Tracheo-Bronchial Tuberculosis and Tuberculosis of the Larynx in 621 Cases Having Laryngeal Examinations

Gross tuberculous tracheobronchitis	Laryngeal tuberculosis	No gross tuberculous tracheobronchitis	Laryngeal tuberculosis
355	210 (59.1%)	266	106 (39.8%)
Of 316 cases of tuberculous laryngitis 210 (66.5%) had tuberculous tracheobronchitis			

mucosa In four of these cases the stenosis was located in one bronchus, the other case was a stenosis involving the middle third of the trachea The degree of stenosis ranged from 20 per cent to 70 per cent of the lumen Only in one case was found atelectasis in the corresponding lung We have not considered in this group the bronchial tuberculosis located in a narrowed bronchus because of surgical collapse or a pleural effusion

Lymph Node Perforations

Finally, six cases were found to be lymph node perforation in the trachea or main bronchi Two were located in the left main bronchus, two in the right major bronchus, one in the upper portion of the trachea, and one in the lower In all of them there was a caseous tuberculosis of the respective lymph node

Tracheobronchial Tuberculosis and Laryngeal Tuberculosis (Table VIII)

Of the 667 cases, only 621 had a laryngeal examination In 316 cases with laryngeal tuberculosis a simultaneous tracheo-bronchial

TABLE VIII
Gross Character of Lesions

Diffuse superficial infiltration	12 (3.2%)
Diffuse deep infiltration with ulceration	85 (22.8%)
Circumscribed ulceration	265 (70.3%)
Stenosis (healed ulceration)	5 (1.3%)
Perforation (lymph node)	6 (1.6%)
Caseous bronchitis	4 (1.0%)
TOTAL	377 (100%)

TABLE IX

Microscopic Character of Selected Cases Having Positive Gross Lesions

With submucous epithelioid tubercles and giant cells only	38 (20.5%)
With specific ulceration	97 (52.4%)
Specific ulceration with fibroid cavernous walls	20 (10.8%)
Non-specific ulceration	15 (8.1%)
Non-specific ulceration with fibroid cavernous walls	2 (1.1%)
Fibrotic lesions with isolated specific foci	4 (2.2%)
Extensive caseation	4 (2.2%)
Non-ulcerative non-specific infiltration	5 (2.7%)
TOTAL	185 (100%)

tuberculosis was found in 210 cases or 66.45 per cent. On the other hand, in 355 cases with tracheobronchial tuberculosis there were 210 or 59.1 per cent with tuberculosis of the larynx. In 266 cases with no tracheobronchial lesions only 106 cases (39.8 per cent) had ulcerations. In far advanced cases the two lesions usually were simultaneous in the larynx and the tracheobronchial tree.

Microscopic Character of the Lesions (Table IX)

The sample including nearly 50 per cent of all gross lesions, was classified according to the microscopic findings. There were 38 cases (20.5 per cent) having only submucous epithelioid tubercles and giant cells with no evident break in the mucosa. Acute specific ulceration was present in 97 cases (52.4 per cent). Chronic specific ulceration was present in 20 cases (10.8 per cent). Non-specific ulceration in which no epithelioid tubercles, giant cell or typical caseation were found, was present in 15 cases (8.1 per cent). Other findings included non-specific ulceration with fibroid walls, 2 cases (1.1 per cent), fibrotic lesions with isolated specific foci, 4 cases (2.2 per cent), extensive caseation, 4 cases (2.2 per cent), and non-ulcerative non-specific infiltration, 5 cases (2.7 per cent).



FIGURE 4

(a) Showing a diffuse tracheo-bronchitis and laryngitis. Discrete ulcers cannot be seen but there is a continuous caseous process throughout.



(b) A healed tracheitis showing strands of fibrous tissue crossing the cartilages.

Control Cases

We have already mentioned the control group of 32 negative cases where 12 (37.5 per cent) microscopically tuberculous lesions were found. Usually the lesion consisted of epithelioid tubercles located in the submucosa or millary caseated foci with early ulceration and specific granulation.

In another group with tuberculous lesions apparently localized to a portion of the tracheobronchial tree, sections were saved at different levels where the mucosa seemed to be normal. In 29 of this type of cases, 12 or 41.4 per cent were found to have microscopic tuberculous lesions. As we have already pointed out, these facts show how widely disseminated are the lesions when the pulmonary tuberculosis is far advanced.

DISCUSSION

There are several features concerning tuberculous tracheobronchitis in general and this study in particular that needs clarification.

One of the most perplexing problems is the disparity of figures given in the literature. For example, it is difficult to reconcile the findings of Bruhig, Littig and Culp¹ who report nearly 50 per cent positive findings, with those of Flance and Wheeler who report only 3.1 per cent, or Wilber's 35 per cent with Auerbach's 4.4 per cent. Figures generally range between these extremes. A few reports, however, may be corrected to give a more uniform result.

For example, Eppinger found only 8 per cent positive tuberculous tracheobronchitis on autopsy material, but he did not include associated tuberculous laryngitis. If a correction is made for the association of the two conditions, the result would be around 25 per cent for all tuberculous tracheobronchitis because more than two-thirds of the cases of tracheobronchitis also have laryngitis.

After weighing all the evidence it is becoming increasingly clear that few cases of far advanced pulmonary tuberculosis are entirely free from tracheobronchial lesions especially after a rigid microscopic search. Since most pulmonary cases become advanced before death, it follows that the majority of cases coming to autopsy should reveal some tuberculous tracheobronchitis. We feel, therefore, that any reports over 50 per cent positive are within the range of the true incidence. The variations above that figure depend upon the percentage of far advanced cases and the care used by workers in finding all the lesions.

Bronchoscopic studies on clinical material also reveal a wide variation in results but the differences can generally be harmon-

ized by considering the type of material. For example, McIndoe and associates²³ report 11 per cent on the examination of *routine* admissions while Sharp and Gorham²⁵ report 33 per cent on cases selected largely as a result of some distressing symptom or symptoms. Differences would also be present due to the difference in stages of the disease admitted to various institutions.

It seems logical that the young ages should be more prone to be affected than are older age groups. In fact, the general tendency to produce exudative lesions, as in the teen ages, female sex, and aboriginal races, may be expected also to produce increased disease in the tracheobronchial tree.

Workers are by no means in agreement concerning the position of the lesions antero-posteriorly. The majority favor the posterior or posterior-lateral walls and we are inclined to agree with this view, but there are also a large percentage of anterior and antero-lateral ulcers. The minor difference may well be due to the position the patients assume during the late stages of the disease.

The apico-caudal localization is influenced somewhat by contiguity to large cavities which spread large numbers of bacilli up the bronchi. Many cases, however, seem to have random localization depending perhaps on the accidental penetration of the mucous glands or breaks in the epithelium wherein bacilli may enter.

The relation of tuberculous laryngitis to tracheobronchitis is no different than the relation of various other parts of the bronchial tree to each other. In about 75 per cent of the positive cases of the tracheo-bronchitis coming to autopsy there is a generalized involvement of all the structures. There are minor percentages, however, where the localizations are confined to only one or two of the other structures. Like tuberculosis in the gastro-intestinal tract, the point of greatest predilection seems to be at a point of stricture where the greatest activity and strain exists. In the air passages the larynx is the most vulnerable point especially in the region of the vocal cords or at the base of the epiglottis.

The question of pathogenesis seems to be more clearly defined than it was a few years ago. The majority of authors (as well as the preponderance of evidence) favors the direct implantation of bacilli, just as in tuberculous enteritis. The ruptured lymphatic nodes and lymphatic extension can generally only be thought of in the relatively rare cases of primary infection. There was no evidence in our series of the "back door" entrance of germs to the mucosa because the structure in and outside of the adventitious layers were free of disease. Equally rare is the hematogenous route of infection.

Finally a few suggestions may be made concerning the future

of the problem of tuberculous tracheobronchitis. Since it is now reasonable to assume that advanced pulmonary disease may develop tuberculous tracheobronchitis, and since most of the cases reveal the dangerous obstruction syndrome where treatment is limited to thoracoplasty, it follows that the earlier treatment is applied the better will be the result. If thoracoplasty is indicated, it should be done without hesitation, but for the cases who do not have such a good fortune there may be some relief in early use of streptomycin. While it is too early yet to evaluate the effect of streptomycin on all forms of pulmonary tuberculosis, there is already evidence that the drug clears up most lesions of the mucosa of the lower respiratory tract. Perhaps this new drug may hold the key to the future of both the distressing obstructive tuberculous tracheobronchitis as well as the ordinary tuberculous lesions of the tract.

SUMMARY

1) A pathological study of tuberculous tracheobronchitis has been made on 667 cases coming to autopsy at the Chicago Municipal Tuberculosis Sanitarium.

2) Gross evidence of tuberculosis was found in 377 cases (56.5 per cent).

3) Microscopic study of a sample of grossly negative cases gave an estimated figure of 37.5 per cent of lesions in the remaining 290 cases, thereby increasing the positive findings of all cases to 72.0 per cent.

4) Counting only the 87.5 per cent of all far advanced lesions, it is observed that well over 80 per cent of far advanced cases have some degree of tuberculous tracheobronchitis.

5) The incidence was increased in the young age groups and in the female sex.

6) The pathogenesis seemed to be best explained by a direct implantation of bacilli in the mucous glands, or through breaches in the epithelium.

7) The location of lesions in the tracheobronchial tree was more or less random, although points of stress (larynx), posterior aspects of the tracheobronchial tree, and proximity to cavities seemed to be affected most.

8) The distribution of lesions was general in 242 cases (64.7 per cent), 65 (17.3 per cent) in lower portions of the tract, 19 (5.0 per cent) in trachea and left bronchus, 9 (2.4 per cent) in trachea and right bronchus, 31 (8.2 per cent) in trachea alone, and 11 (2.9 per cent) in bronchi alone.

9) The nature of the involvement was diffuse superficial infiltration in 12 cases (3.2 per cent), diffuse and deep infiltration and

infiltration and ulceration in 85 cases (22.8 per cent), circumscribed ulceration in 265 cases (70.3 per cent), fibroid stenosis in 5 cases (1.3 per cent), perforation in 6 cases (1.6 per cent), and caseous bronchitis in 4 cases (1.0 per cent)

10) There was microscopic evidence of specific tuberculous lesions in 88.1 per cent of the positive cases studied

11) The hope for the future of tuberculous tracheobronchitis seems to be for early bronchoscopic study of all cases, early diagnosis, and early treatment of positive cases by thoracoplasty or streptomycin, or both

RESUMEN

1) Se llevó a cabo un estudio patológico de la tráqueobronquitis tuberculosa en 667 casos autopsiados en el Sanatorio Municipal para Tuberculosos de Chicago

2) Hubo hallazgos macroscópicos de tuberculosis en 377 casos (56.5 por ciento)

3) El estudio microscópico de una muestra de los casos que fueron negativos macroscópicamente dio una cifra calculada de 37.5 por ciento de lesiones en los 290 casos restantes, lo que aumentó los hallazgos positivos en todos los casos al 72.0 por ciento

4) Si se cuenta solamente el 87.5 por ciento de todas las lesiones muy avanzadas, se observa que más del 80 por ciento de todos los casos muy avanzados presentan algún grado de tráqueobronquitis tuberculosa

5) La frecuencia fue más elevada en los grupos etarios jóvenes y en el sexo femenino

6) Parece que la mejor explicación de la patogenia es la implantación directa de los bacilos en las glándulas mucosas o a través de aperturas en el epitelio

7) La ubicación de las lesiones en el árbol tráqueobronquial fue más o menos al azar, aunque los puntos de esfuerzo (la laringe), los aspectos posteriores del árbol tráqueobronquial y los lugares en la proximidad de cavernas parecían estar más afectados

8) La distribución de las lesiones fue general en 242 casos (64.7 por ciento), 65 (17.3 por ciento) en partes inferiores del aparato, 19 (5.0 por ciento) en la tráquea y el bronquio izquierdo, 9 (2.4 por ciento) en la tráquea y el bronquio derecho, 31 (8.2 por ciento) en la tráquea sola y 11 (2.9 por ciento) en los bronquios solos

9) La naturaleza de la invasión fue infiltración superficial difusa en 12 casos (3.2 por ciento), infiltración difusa y profunda e infiltración y ulceración en 85 casos (22.8 por ciento), ulceración circunscrita en 265 casos (70.3 por ciento), estenosis fibrosa en 5 casos (1.3 por ciento), perforación en 6 casos (1.6 por ciento) y bronquitis caseosa en 4 casos (1.0 por ciento)

10) Hubo hallazgos microscópicos de lesiones tuberculosas específicas en 88.1 por ciento de los casos positivos estudiados

11) La esperanza de la tráqueobronquitis tuberculosa en el futuro parece depender del estudio broncoscópico temprano de todos los casos, del diagnóstico oportuno y del tratamiento temprano de los casos positivos mediante la toracoplastia o con estreptomycin, o con ambos

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Studies of Venous Pressure, Vital Capacity, Circulation Times and Electrocardiograms in the Course of Pulmonary Collapse Therapy*

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INTRODUCTION

This study was stimulated through the observation, by one of us (L.H.H) of the appearance of the picture of right-sided heart failure in two patients who had been receiving artificial pneumothorax. Our purpose was to see if we could detect, early in the course of collapse therapy, any evidences of right heart strain. In addition to clinical observations we employed certain laboratory procedures which will be discussed below. Other similar studies have been carried out in this regard but as yet there has been nothing to demonstrate definite evidence of cardiac strain induced by collapse therapy.

Kroetz (quoted by Heise and Steidl⁹) in 1922 was apparently the first to study the venous pressure of patients before and after pneumothorax. Grellety-Bosirel (quoted by Heise and Steidl⁹) found that as a rule the establishment of pneumothorax produces no modifications of venous pressure. Gerdier (quoted by Heise and Steidl⁹) concluded that in pneumothorax venous pressure was a valuable indication of circulatory obstruction not always detected by clinical observation. He stated that venous pressure could predict that the collapse should be interrupted even when auscultation, x-ray studies and the respiratory rhythm failed to forecast disaster. However, others¹⁻⁹ have failed to note any significant changes of venous pressure during collapse therapy. Studies of the circulation time¹⁻⁶⁻⁷ have consistently shown a decrease with induction of collapse therapy but nothing to indicate right heart failure. Dock and Harrison¹¹ found in rabbits an initially increased volume flow of blood through the lungs and a delayed decreased volume flow. Electrocardiographic studies³⁻⁶⁻¹⁰⁻¹⁴⁻¹⁶ have shown some changes which have been ascribed largely to rotation of the heart or the presence of air in the chest interfering with conduction of the heart current. In our present study we have

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employed all of these laboratory tests to determine the effect of pulmonary collapse on the circulation

Method

The patients studied all had pulmonary tuberculosis of varying degree. A total of 32 patients were studied. They were classified in four groups based on the extent of parenchymal involvement as seen on the x-ray film. Groups I and II were based on⁶ the standards of the N T A * classification. Group III did not follow this classification strictly because we felt that these patients with a cavity greater than 4 cm in diameter would still remain in Group II providing there was not other parenchymal involvement to exceed the amount of lung tissue in one complete lung. Group III included those patients with involvement greater than the total tissue of one lung and Group IV included those patients with diffuse involvement of both lungs.

In the above groups there were thirty patients with artificial pneumothorax and two with unilateral phrenicotomy. All studies were carried out in a room at a uniform temperature of 26° C. The patient was allowed to rest for a full fifteen minutes before the tests were begun. The patient was first fluoroscoped and then vital capacity was determined using the McKesson apparatus and having the patient in an erect position.⁷ The venous pressure was then determined in the antecubital veins bilaterally, using an 18-gauge needle and reading the venous pressure against a column of 4 per cent sodium citrate solution. The level of the vein was adjusted approximately to the level of the right atrium using the angle of Louis as a measuring point. Two per cent novocaine was injected intradermally at the site of insertion of the measuring needle. All pressures were determined in the left arm first and then in the right. With the right needle in place a mixture of five cubic centimeters of 20 per cent decholin solution and five minims of ether was injected rapidly into the vein. The patient was instructed to indicate immediately when the sensations of ether and a bitter taste were perceived. The responses were timed by stop watch. Electrocardiograms were then taken with the patient in a recumbent position. None of these patients had any elevation of temperature above 99° F at the time of the tests. They were all thoroughly instructed in what to expect, thus eliminating fear. All procedures were carried out on the same day. Control studies were carried out about a week after the patient's admission to the hospital. Follow-up studies were then done one month and five months following the institution of collapse therapy.

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Results

Of the 32 patients, 12 were in Group I, 9 were in Group II, 7 were in Group III, and 4 were in Group IV, according to the above-mentioned classification

Vital Capacity of the Lung

The study of the vital capacity in these patients revealed a progressive linear decrease with the increased degree of collapse. These findings are well illustrated in Table I. As can also be noted there apparently was no significant reduction in the control vital capacity of the lung until the class three and four cases were studied.

Venous Pressure and Circulation Times

In Table II we indicate the average circulation times and venous pressure ranges in the four classes of cases. It will be seen that there is a definite decrease in the circulation time in Group III and IV and definitely low venous pressure in Groups III and IV. The decrease in circulation time was accounted for chiefly by a changes in the pulmonary circulation time. The changes incident to the establishment of pulmonary collapse are noted in Table III. The degrees of increase or decrease are noted as measured against the average control values for each class. There was no significant

TABLE I

Class of Disease	1	2	3	4	All Groups
	Per cent	Per cent	Per cent	Per cent	Per cent
Average Control* Vital Capacity	96	87.3	82.2	71	84
Average Reduction in Vital Capacity	76	63	64	53	64
One Month Following Institution of Collapse Therapy	or -20	or -24.3	or -18.2	or -18	or -20
Average Reduction in Vital Capacity	69	57	48	34	52
Five Months Following Institution of Collapse Therapy	or -27	or -30.3	or -34.2	or -37	or -32

*Throughout this study the average has been calculated by simple arithmetical division of the total for all cases divided by the number of cases. The differences between the individual cases was so little that we felt this would be sufficient in determining the significance of our findings. The few instances in which there was greater deviation are discussed in the text of the paper.

difference in the venous pressure between the right and left arms either before or after collapse. In Groups I and III there was definite decrease in circulation time which seemed to be chiefly accounted for by a decrease in the ether time. This was much less marked in Groups III and IV, the possible explanation for which will be noted later.

It will be seen that the changes which occurred in circulation time at the end of one month of collapse therapy remained about the same at the end of five months, although in many instances the degree of collapse was greater at the end of five months.

Electrocardiographic Changes

In general the changes were not marked and certainly were not consistent with any definite evidence of cardiac strain. There was no apparent correlation of the degree of pulmonary collapse, extent of the disease, the degree of mediastinal shift or the side of the collapse with any specific change in the tracings. Alterations in venous pressure or circulation time also had no consistent bearing on the appearance of the cardiogram.

TABLE II

<i>Circulation Time</i>				
Class	1	2	3	4
Ether	7.5 sec	9.0 sec	6.2 sec	6.3 sec
Decholin	13.5 sec	13.0 sec	12.4 sec	12.1 sec
Venous Pressure	8 cm	4.9 cm	4.1 cm.	4.1 cm

TABLE III

<i>Average Change in Circulation Time</i>						
Class		1	2	3	4	All
Ether	1 mo	-1.2 sec	-3.2 sec	-1.0 sec	-0.8 sec	-1.6 sec
Ether	5 mo	-0.6 sec	-2.4 sec	-0.7 sec	-1.1 sec	-1.2 sec
Decholin	1 mo	-2.1 sec	-3.2 sec	+0.7 sec	-1.1 sec	-1.4 sec
Decholin	5 mo	-1.0 sec	-2.7 sec	-0.2 sec	-0.6 sec	-1.1 sec
<i>Average Change in Venous Pressure</i>						
	1 mo	+0.8 cm	+0.2 cm	+1.4 cm	No Change	+0.6 cm
	5 mo	-1.0 cm	-1.2 cm	-0.5 cm	No Change	-0.7 cm

The average cardiac rate in these 32 cases was 88 per minute. Eleven of them were below 80 and some of these had far advanced disease. At the end of one month of collapse therapy there was uniform increase in the heart rate. At the end of five months, 13 patients still had increased heart rates, 7 were decreased, and 15 were unchanged. Again there seemed to be no correlation between the changes in heart rate and the stage of the disease. None of the patients developed any arrhythmia. Four cases showed development of some right axis deviation. This was most pronounced in a patient who had a minimal mitral lesion in addition to his tuberculosis. He has been receiving pneumothorax now for 16 months and has shown no clinical evidence of right heart strain. In three of these cases the pneumothorax was on the right side. In one case it was bilateral.

The most consistent changes observed at the end of one month of institution of collapse therapy were

- 1 Decrease in the voltage of the R wave in 17 cases in Lead I and in 16 cases in Lead IV-F,
- 2 Decrease of the T wave in 15 cases in Lead I and in 18 cases in Lead IV-F,
- 3 In 9 cases, a decrease of T wave in Lead II,
- 4 In 10 cases, an increase of the R wave in Lead III which was accompanied in 5 cases by an increase in the S wave of Lead I,
- 5 In 6 cases, a decrease of the T wave in Lead III,
- 6 No change in 4 cases

At the end of five months no further consistent changes were observed. An interesting observation was that the changes in Lead I seemed to be mirrored by the changes in Lead IV-F.

Discussion of Results

As stated at the outset of this paper, we attempted to demonstrate early evidence of right heart strain in the institution of collapse therapy. As can be gleaned from our results there is no evidence of right heart failure so far as these cases have been followed by the procedures herein utilized. It may be added that in no case was there clinical evidence of congestive failure, although some of the patients complained of dyspnea.

Studies of the vital capacity revealed an almost linear reduction with the increase of pulmonary collapse. This is quite obvious since the vital capacity is dependent on the volume of respiratory surface. This finding has also been pointed out by Stewart and Bailey⁶ and Feinsilver.¹ We feel that the determination of the vital capacity is of little value in determining the presence of involvement of pulmonary tissue unless this is rather extensive. Apparently the uninvolved portions of lung can compensate greatly until so much

lung is involved as in the Group III and IV cases that there is a significant diminution in respiratory reserve with consequent reduction in vital capacity. These findings are corroborated by others.²

On the whole, these patients in their control studies exhibited normal circulation times, using 13 seconds for the decholin time and 7 seconds for the ether time as normals. There were occasional patients in whom the circulation time seemed to be a little prolonged but there were no particular factors with which to correlate these findings. The circulation times in the Groups III and IV patients seemed to be more rapid. The fact that this was chiefly accounted for by a decrease in the ether time would suggest that extent of involvement of the pulmonary tissue may have sufficiently diminished the size of the vascular bed to account for the above reduction. The circulation times were also uniformly decreased with collapse therapy. This seemed to be most marked during the first month and less at the end of five months. The fact that this was less marked in the Group III and IV cases was probably due to the greater difficulties in obtaining good collapse in these cases. The changes again were due principally to reduction in the ether time and again we explain the changes through a reduction in the pulmonary vascular bed. The fact that these changes are less marked at the end of five months in view of increased pulmonary collapse can be explained only on the basis of change in heart rate since at the end of one month the heart rates were uniformly increased over the control levels, whereas at the end of five months in only less than half of the cases was there still an increase in heart rate. Feinsilver¹ has noted essentially similar findings. Others^{6,7} have noted very little change in the circulation times.

Venous pressure readings in the controls were essentially normal. They tended to be generally lower in the Group III and IV cases. It has been pointed out¹³ that there is some evidence of emaciation being a factor in lowering of venous pressure. This is the only factor we could evolve as an explanation for the above since such things as vis-a-tergo or intrathoracic pressure could not be demonstrated to be essentially different in the Group III and IV and in the Group I and II cases. With collapse therapy, there was in general a slight rise in venous pressure at first but this promptly subsided. These changes were not large enough to be considered of any significance. In one of the Group III cases, there was a significant rise of venous pressure bilaterally (3 cm), which was maintained at the end of five months. However, we could demonstrate no evidence of right heart failure to explain this. There was one other patient in Group I who had a rise in venous pressure of 3 cm bilaterally at the end of one month but this promptly

returned to normal levels at the end of five months. There was no mediastinal shift or any particular adhesions to explain the temporary but definite rise in this case. It has been found by others^{1,6,9} that there were no significant changes in venous pressure incident to collapse therapy. We noted that the degree of mediastinal shift has no particular effect on the venous pressure. A few cases with marked pleural effusion and pronounced mediastinal shift showed little or no alteration in the venous pressure.

Hurst and Brand⁸ have pointed out that high tension pneumothorax may cause a rise in venous pressure on the same side, with or without mediastinal shift. They feel that venous pressure changes occur on the side of the more extensive tuberculous lesion or collapse measure and explain it on the basis of local obstruction of the subclavian or innominate vein. This phenomenon did not occur in our studies so far as we have carried them. It is not surprising that we did not observe more changes indicative of increased tension in the pulmonary circuit since it has been pointed out¹² that the vascular bed of the lungs must be reduced by about 60 per cent before the pressure is increased in the lesser circulation.

The electrocardiographic studies revealed even less evidence of any cardiac strain than did the above discussed procedures. As previously mentioned the most consistent findings were decrease of the R and T waves in Lead I and IV-F. As Master¹⁴ has suggested the low voltage of the Q-R-S complex and the T waves is probably to be accounted for either by the rotation of the heart or by the fact that air in the chest is a poor conductor for the heart current. We are inclined to lean to the latter explanation since in these cases we were not able to demonstrate actual cardiac rotation fluoroscopically. In four patients there was development of right axis deviation, the pneumothorax being on the right side in three cases and bilateral in one case. In Master's¹⁴ cases all of the patients with right pneumothorax showed a right axis deviation of the Q-R-S complex. He feels that in right pneumothorax particularly that a rotation of the heart occurs and probably accounts for the above. He followed two cases who showed disappearance of the above changes with disappearance of the pneumothorax. His study, however, was concerned with only seven cases, five of which were spontaneous pneumothorax. He found the most marked changes with displacement of the mediastinum. We could not conclude that in one case with marked mediastinal shift that any greater change was noted in the electrocardiogram. Anderson³ found that neither the degree of pulmonary collapse maintained nor the duration of the collapse therapy had any definite relationship to the form of the electrocardiogram. Again his study was different from ours in that he did not compare the

electrocardiograms of the same patient before and after pneumothorax Hansen and King¹⁶ felt that the change observed, most frequently in the R and T waves, were due to change in position and not myocardial damage Similar conclusions have been reached by others⁶ Boas and Mann¹⁵ feel however that displacement of the heart in their experience had no effect on the result of the electrocardiograph Our studies seemed to corroborate the latter statement Simon and Baum¹⁰ consider the presence of adhesions as important in producing predominance of either ventricle This could not be demonstrated in our series It appears that in those cases in which axis deviation appeared that it was due to rotation of the heart The change in the R and T waves was most likely on the basis of presence of air in the chest

SUMMARY

Simultaneous studies of the venous pressure, circulation time, vital capacity of the lung, extent of pulmonary involvement, and electrocardiograms have been made in a series of 32 cases with pulmonary tuberculosis

These studies were carried out as controls and again at the end of one month and five months after institution of collapse therapy In 30 cases collapse was induced by artificial pneumothorax and in two cases by phrenicotomy Factors of emotion, environmental temperature, and body temperature were noted and controlled The control studies were carried out after the patient had been in the hospital for a week

The purpose of the study was to try to demonstrate any evidence of right heart failure early in the course of collapse therapy These patients were observed clinically as well as through the laboratory

CONCLUSIONS

- 1) In no case was there clinical or laboratory evidence of right heart strain
- 2) Decrease of vital capacity of the lung is directly proportional to the degree of collapse Vital capacity does not seem to be materially affected in the controls until there is extensive pulmonary involvement
- 3) The venous pressure is not significantly affected by pneumothorax or phrenicotomy
- 4) The circulation times are decreased initially by pulmonary collapse chiefly due to a decrease in the ether time It is suggested that this results from a decrease in the pulmonary vascular bed and an increase in heart rate
- 5) The electrocardiogram has shown no evidence indicative of

right heart strain The changes noted apparently are due to rotation of the heart and presence of air in the chest

6) Only through more prolonged studies of these patients, may it be possible to detect any changes in the procedures herein employed which may indicate evidence of right heart failure before frank clinical features appear

RESUMEN

En una serie de 32 casos de tuberculosis pulmonar se han llevado a cabo estudios simultáneos de la presión venosa, velocidad de circulación, capacidad vital del pulmón, extensión de la invasión pulmonar y electrocardiografías

Se hicieron estos estudios, primero para que sirvieran de pauta, y se repitieron después de un mes y después de cinco meses de haberse iniciado la colapsoterapia En 30 casos la forma de colapso empleada fue el neumotórax artificial, y en dos casos la frenicotomía Se tomó en cuenta y se corrigió el factor emocional y, también, la temperatura del ambiente y del cuerpo Se llevaron a cabo los estudios reguladores después de que el paciente había estado una semana en el hospital

El propósito del estudio fue el de tratar de demostrar tempranamente en el curso de la colapsoterapia signos de insuficiencia del corazón derecho Se observó a estos pacientes tanto clínicamente como con exámenes de laboratorio

CONCLUSIONES

1) En ningún caso hubo signos clínicos o de laboratorio perjudiciales al corazón derecho

2) La disminución de la capacidad vital del pulmón es directamente proporcional al grado de colapso No pareció ser afectada notablemente la capacidad vital de los reguladores sino cuando existía invasión pulmonar extensa

3) Ni el neumotórax ni la frenicotomía afectan importantemente la presión venosa

4) El colapso pulmonar causa inicialmente una disminución en el tiempo de circulación debida, principalmente, a disminución del tiempo del éter Se supone que esto es debido a disminución en la red vascular pulmonar y a aumento en el numero de latidos del corazón

5) La electrocardiografía no ha revelado ningún signo indicativo de daño al corazón derecho Las alteraciones observadas se deben aparentemente a la rotación del corazón y a la presencia de aire en el tórax

6) Sólo mediante estudios más prolongados de estos pacientes

podría ser posible descubrir en los procedimientos aquí empleados alteraciones que pudieran indicar insuficiencia del corazón derecho antes de que aparezcan francos signos clínicos

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Right Heart Failure After Thoracoplasty*

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From a study of the available literature it would appear that little attention has been paid to the question of cardio-pulmonary insufficiency after long-standing thoracoplasty. In the Scandinavian literature¹ two cases are reported in which death occurred three and four years respectively after thoracoplasty with necropsy findings of distinct right cardiac hypertrophy and dilatation. In a recent article on chronic cor pulmonale² one case is mentioned in which marked right ventricular hypertrophy was found at necropsy, nine years after a thoracoplasty. The authors state "undoubtedly, the question of whether or not long-standing thoracoplasty may result in a strain on the right side of the heart is a subject which deserves further study." We recently had occasion to observe two cases of cardio-pulmonary insufficiency after long-standing thoracoplasty.

CASE REPORTS

Case 1 I. C., White, female, 39 years old. Diagnosis of pulmonary tuberculosis in 1934. Pneumothorax on the right instituted in June 1936. Permanent phrenic paralysis performed in July 1936. Tuberculous empyema with bronchopleural fistula developed in 1939. Patient was admitted to the National Jewish Hospital and a thoracotomy followed by a three stage ten rib thoracoplasty and Schede procedure was performed. Vital capacity which was found to be 36 per cent before the operation was 26 per cent after surgical procedure. After discharge from the institution patient was seen in the Out-Patient Department at regular intervals. She presented no complaints except for slowly increasing dyspnea on exertion. In the last week of May 1946 she developed what seemed to be an upper respiratory infection with slight temperature elevation and nonproductive cough. There was severe increasing dyspnea despite routine treatment of the upper respiratory infection and she was readmitted to the hospital. On examination she was found to be dyspneic, orthopneic and cyanotic. Tachycardia with a pulse rate up to 140 was present. Blood pressure which had been normal previously was elevated to 170 systolic and 108 diastolic. Slight distention of the neck veins was noted and tenderness to pressure was found over the right upper quadrant. X-ray film showed cardiac enlargement by comparison with previous films. EKG gave evidence of slight right axis deviation. Venous pressure studies were done and showed elevation to 21 and 24.5 cm respectively on the right and left side with positive response to right upper quadrant pressure (Pasteur-Rondot test³). She was placed on bedrest and given a full course of digitalization with a purified digitalis

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product Her dyspnea subsided gradually with disappearance of the other chemical findings and she was discharged after three weeks At the time of discharge, x-ray film showed reduction of her heart size, venous pressures were in normal range (R A 5 and L A 9) and the modified Pasteur-Rondot test was negative She was given a maintenance dose of digitalis and advised to move to a lower altitude According to reports received from her since, she has had no further episodes of cardiac decompensation and her exertional dyspnea has been reduced

Case 2 P M, White, female, 46 years old Onset of pulmonary tuberculosis in 1922 with hemoptysis Left pneumothorax was induced and permanent left phrenic paralysis performed in 1930 Because of evidence of cavity in the left upper lobe and positive sputum she was re-admitted in 1935 and a four rib thoracoplasty on the left was performed She was followed in the Out-Patient Department and presented no complaints except gradually increasing dyspnea on exertion In February 1946 she was seen in the Out-Patient Department with indefinite gastro-intestinal symptoms Gall bladder and gastro-intestinal x-ray series were negative Chest x-ray film showed definite cardiac dilatation, EKG, right axis deviation with signs of right ventricular strain She was not seen again until August 1946 when she was first admitted to a general hospital in full congestive failure She was digitalized and after a short stay was re-admitted to the National Jewish Hospital On admission she was markedly dyspneic and cyanotic, with moist rales over the bases, liver enlargement and ankle edema Venous pressures were R A 12, L A $16\frac{1}{2}$, right upper quadrant pressure resulted in venous pressures of R A 18, L A 23 EKG showed right ventricular strain and digitalis effect, x-ray film gave evidence of marked cardiac enlargement Her digitalization was continued and oxygen was given by nasal catheter Her condition improved with reduction of edema and weight Venous pressures returned to normal, R A 6 and L A 9.5 When oxygen was discontinued, her edema recurred and despite low sodium-acid ash diet and intensive use of mercurial diuretics she showed increasing fluid retention Oxygen was again begun and after a time she was discharged home where she continued on the same routine with no improvement in her condition She died in congestive failure in October 1946 No necropsy was done

Discussion and Comment

From a clinical point of view the two above described cases illustrate the importance of early recognition of the cardiac factor in patients developing cardio-pulmonary insufficiency in chronic pulmonary tuberculosis with permanent collapse procedures The anoxemia caused by the ventilatory-respiratory insufficiency, results in dyspnea and cyanosis and the superimposed cardiac involvement can be recognized "early" only if attention is paid to "specific" cardiac signs of right heart failure If only suggestive evidence is found, the patient should then be subjected to a thorough diagnostic work-up, including x-ray, electrocardiogram, and venous pressure studies Our observations on these two and other cases of cardio-circulatory failure in chronic pulmonary disease have led us to endorse Spain and Handler's² impression that routine cardiac treatment, especially digitalization, seems to

be of value only if applied early We also believe that oxygen should be administered early so as to prevent irreversible changes in the myocardium as well as pulmonary edema

As to the causes of right heart failure after thoracoplasty there is a wide field for speculation Bruce¹ feels that the marked kyphoskoliosis developing in some cases of thoracoplasty may be an important factor He states "the plastic patient often shows a striking gross anatomic resemblance to the kyphoscoliotic patient" As attractive as this theory is, in neither of our cases was there sufficient deformity to consider it of etiological significance

Studies of the respiratory function of lungs before and after thoracoplasty by bronchspirometry as those by Pinner, Leiner, and Zavod⁴ tend to prove that respiratory function is not unfavorably influenced by thoracoplasty However, they state that this does not apply to thoracoplasties with pre-existing or added diaphragmatic paralysis This was present in our two cases and probably contributed to the pulmonary insufficiency It is necessary to point out that even temporary phrenic crush may result in permanent paralysis or at least partial palsy From our own experience we feel that this measure contributes greatly to impairment of cardiopulmonary reserve

Kaltreider, Fray and Phillips⁵ in an interesting study of pulmonary-ventilatory and respiratory function as well as function of the cardiovascular apparatus came to the conclusion that surgical interference with the chest-cage results in an anoxic anoxemia The average value for the oxygen content of the arterial blood was below the average normal value However, frank signs of right ventricular failure were not noted in their series and they state "this is not surprising when one realized that the vascular bed of the lungs must be reduced by approximately 60 per cent before the pressure is increased in the lesser circulation" They make the additional statement "there are however, other factors, such as anoxemia of the myocardium which may put an additional load on the right ventricle in patients with thoracoplasty"

Cardiac failure in chronic pulmonary tuberculosis with permanent collapse procedures is obviously due to a combination of factors The collapsed pulmonary area is usually not large enough to cause persistent pulmonary hypertension and its sequel, cor pulmonale Additional factors which have been considered such as rigidity of the chest wall which interferes with normal respiratory-circulatory cycle, compensatory emphysema of the uncollapsed lung parenchyma of the thoracoplasty lung, capillary congestion and emphysema of the contralateral lung may each be contributory The result of combining any of these factors appears to be anoxic anoxemia resulting in an added burden to

the myocardium This chronic anoxemia as well as obliteration of part of the pulmonary capillary bed plus additional factors of age, coronary artery disease, or intercurrent upper respiratory infection will result in heart failure

Obviously no definite causal relationship can be claimed to exist between the permanent collapse procedure performed in the two presented cases and the occurrence of right heart failure However, by prolonging the life expectancy of individuals with chronic pulmonary tuberculosis by thoracoplasty, we may be presented with an increasing incidence of cardiac failure It is definitely felt that patients with chronic pulmonary disease with or without collapse procedure who are dyspnoeic should be enjoined to live at low altitudes to avoid any additional strain upon the myocardium

SUMMARY

1) We have presented two cases of right heart failure with chronic pulmonary tuberculosis with associated thoracoplasty and permanent phrenic paralysis

2) While the theoretical considerations for such an association have been given, no definite causal relationship could be postulated

3) Regular cardiovascular examinations were stressed for patients with increasing dyspnoea who had undergone permanent collapse procedures Early treatment in cases of right heart failure appeared of definite value in restoring compensation as opposed to late cases

RESUMEN

1) Hemos presentado dos casos de insuficiencia del corazón derecho con tuberculosis pulmonar crónica, asociada con toracoplastia y parálisis permanente del nervio frénico

2) Aunque se han dado las razones teóricas de tal asociación, no se pudo enunciar ninguna relación causal bien definida

3) Se recalcó la importancia de llevar a cabo exámenes cardiovasculares metódicos en pacientes con disnea creciente que habían sido sometidos a procedimientos permanentes de colapso El tratamiento temprano de los casos de insuficiencia del corazón derecho pareció ser de valor bien definido para restablecer la función cardíaca, en contraste a los casos tratados tardíamente

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The Synergism Between Mycotic and Tuberculous Infections of the Lungs*

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INTRODUCTION

The idea of a commensal relationship between fungus and tuberculous infections of the lungs has been suggested in the past. It is my impression that the importance of their coexistence has not been fully appreciated by the medical profession. The prevalent knowledge that fungi are ordinarily saprophytic and ubiquitous has, perhaps, led us into the erroneous attitude that all fungi found in the sputum are harmless contaminants, and their importance as a factor in an existing tuberculous process is slight and of no consequence in the consideration of the subsequent course of the tuberculous invalid who is unfortunate enough to be the host to both a tuberculous and a fungus infection. My object in this paper is to refute the impression that these co-existing fungi are harmless, saprophytic invaders, and to advance added data to support the premise that an infection of the lungs with pathogenic fungi in association with a tuberculous infection of the lungs is not harmless and coincidental, but that it definitely increases the activity and virulence of the tuberculous process. An attempt will be made to analyze the possible ways in which this activation or modification takes place. Furthermore, it is hoped that a free discussion at this meeting may add to our knowledge of the underlying reasons for this increased invasiveness of the mycobacterium tuberculosis when a mycotic infection is also present, especially valuable will be observations along the trends of bacteriological, biochemical and immunological analysis.

The Problem of Diagnosis

The detection of a fungus infection with, or without, the presence of pulmonary tuberculosis may be fraught with difficulty. The symptoms and clinical course of pure pulmonary mycoses may be identical with those of pulmonary tuberculosis. Even the roentgenogram may be of no differential value. It is well to remember that fungi found in the expectorated sputa are usually saprophytic, especially is this true of the aspergillus, penicillium,

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and the saccharomyces It has been affirmed that the aspergilli and the penicilia are three times more frequently found than all other species combined It has been my personal experience that the saccharomyces are found saprophytically in the sputum more commonly than both the aspergillium and the penicillium species There is only one certain way to guard against the inclusion of saprophytic fungi, and that is by obtaining the specimen for examination by intratracheal aspiration, cultivation on Sabouraud's medium, and animal inoculation to prove the pathogenicity of the fungus The problem is also enhanced by the relationship of certain fungi, the actinomyces, to the mycobacteria Most bacteriologists¹ classify both the mycobacteriaceae and the actinomycetaceae under the order actinomycetales, and identify them as bacteria (schizomycetes) There is no doubt that the actinomycetes are phylogenetically very closely related to the mycobacteria tuberculosis Certain acid-fast forms of actinomycetes bear a close resemblance to the tubercle bacilli in morphology, cultural characteristics, pathogenicity and immunity reactions The actinomycetes are very labile and prone to change their morphology, and some species may at least temporarily fail to form a mycelium and grow entirely in a bacillus-like form

Common Forms of Fungi Observed

The pathogenic fungi, found in association with pulmonary tuberculosis in our studies² of the problems were, the cryptococcus hominis, monilia bronchialis, saccharomyces hominis, aspergillus fumigatus, sterigmatocystis nidulans, and sporotrichum schencki The penicillium fungus was never encountered even as a probable saprophyte in the expectorated sputum The fungi, listed above, comprise the results in 12 cases of proved tuberculosis in whom we succeeded in isolating the fungi, by intratracheal aspiration, in pure culture, followed by animal inoculations in which the fungi were recovered from the animals' lung tissues In 8 other patients, in whose sputum tubercle bacilli were absent, fungi were similarly isolated, and studied with like results Five of these cases were pure bronchomycoses, including 3 cases of sporotrichosis, one aspergillosis, one cryptococcosis One bronchiogenic carcinoma was found in association with moniliasis There were 27 patients, whose expectorated sputa contained fungi, which we were not able to obtain from the trachea We classified them as saprophytes They were identified as 2 cases of cryptococcus Kützing, 2 monilia Persoon, 2 sporotrichum Link, 2 acremonium Link, 2 aspergillus Micheli and 17 cases of saccharomyces Meyen

There has been a gradual, but progressive, evolution in the conviction among physicians, during the past decade, that pul-

monary mycoses, associated with pulmonary tuberculosis, must be searched for and seriously considered in every patient with pulmonary tuberculosis. Dodge³ reviewed the literature up to 1933, and found only 26 cases of pulmonary mycoses, which either simulated pulmonary tuberculosis, or were in association with a tuberculous infection of the lungs. This would indicate, considering my personal experience, that the relationship of the two diseases was not being seriously considered, and the fungus organisms were not being diligently sought for in the sputa of tuberculous patients before that time. Dodge found 19 cases of filamentous fungi, listed as 9 cases of nocardia, 2 oidium, 2 sporotrichum, 2 penicillium, 2 aspergillus, and 1 sterigmatocystis. There were found 7 cases of yeast-like fungi, diagnosed as 4 cases of cryptococcus, 2 monilia, and 2 endomyces. It is to be noted that of Dodge's 19 cases there were 13 of the classification of fungi imperfecti, and of our 18 cases of proved pulmonary mycoses, with and without tuberculosis, 10 of the fungi were fungi imperfecti. It would seem logical that we may expect fungi imperfecti to be found in two-thirds of the mycotic infections of the lungs. Other recent reports also indicate this to be true.

Previous Observations

Mary Lapham⁴ wrote in 1926, "There are cases of aspergillosis on record which subsequently became tuberculous, and Renon says that this is a dangerous feature of the disease. While it is not generally believed that the development of tuberculosis is in any way associated with a disease so rare that it is a curiosity, how do we know that this disease is so infrequent? Would it be strange if such a disease should seriously complicate, or even inhibit recovery in a case of tuberculosis?" She subsequently stated that when a case of tuberculosis is complicated by aspergillosis, recovery seems more difficult and more unstable because there is a decided tendency to relapses. Also, Castellani⁵ reported that some of these mycotic infections resemble tuberculosis clinically, and that the physical and roentgenologic findings will not aid in differentiating them from tuberculosis. Numerous observers have noted the malign effects the presence of a fungus infection has upon the course of pulmonary tuberculosis. This fact seems established firmly in the minds of competent clinicians.

Symbiotic and Synergistic Considerations

A consideration of the symbiotic relationships between mycobacteriae tuberculosis and fungi leads us into the realm of speculation, diverse viewpoints, and lack of definite knowledge. Perhaps one may seem bold, indeed, who essays to piece together the

available knowledge, and add purely theoretical considerations of his own, dealing with the symbiotic and synergistic problems of mycotic and bacterial association as they pertain to the problem before us today. The term "symbiosis" will be used in the same sense as employed in general biology, rather than in the more restricted conception of bacteriologists. In the latter meaning symbiosis refers to the growth of certain bacteria only in the presence of certain other bacteria.

The theories of Professor Wallin⁶ embody clearcut facts of symbiosis in the sense to be used in our discussion. He has proposed the term "prototaxis" to express a principle, defined by him, as "the innate tendency of one organism or cell to react in a definite manner to another organism or cell," and "positive prototaxis," as "the affinity of one organism or cell for another organism or cell." The term "symbiosis," then, indicates mutual benefit is derived, "parasitism," on the contrary, presupposes some benefit to the parasite with either a harmful or no response on the part of the host. Wallin further affirms "symbiosis is applied to those cases where mutual benefit is derived. It is evident that there is no sharp distinction between parasitism and symbiosis considered from the point of view of prototaxis, parasitism and symbiosis are merely different end responses in the expression of one and the same biological principle."

We have no proof that there is any symbiotic relationship between tubercle bacilli and pathogenic fungi when they are subjected to the same cytoplasmic environment in the lung tissues. We know they are subjected to the same encompassing factors—thermal, photic, electrical, chemical, and physical. It may be probable that in combined fungus and tuberculous infections of the lungs that the tuberculous implantation may be the primary one, and that the fungi, attacking the lungs later, produce some change, chemical or physical, which reactivates tubercle bacilli, which have become less virulent because of localizing and focalizing tissue processes and specific immunologic influences. Recently, reports from the Edward J. Meyer Memorial Hospital and the Department of Medicine, and the University of Buffalo School of Medicine,⁷ stated that subcultures of a mold of the penicillium group, obtained from a contaminated culture of tubercle bacilli, showed rapid and luxuriant growth on other cultures of tubercle bacilli at room temperature, that the mold grew faster and sporulated earlier than it did on similar sterile media. Their further experiments indicated the mold inhibited the growth of tubercle bacilli in culture, and, also inactivated tuberculin in two hours. This tendency for molds to inactivate tuberculin, that show bacteriostatic activity against tubercle bacilli in the test tube, had

been previously observed by others. In these test tube experiments, although no growth of tubercle bacilli was observed, acid-fast bacilli were still present in smears after several months incubation of the tubes. Could these findings suggest the mold, when in association with tubercle bacilli in the lungs, inhibits the building up of specific immunity, local and systemic, on the part of the tubercle bacilli? The conditions within the tissues of the lungs are vastly different than in the laboratory test tube. In the former it is quite unlikely the implantation of tubercle bacilli and fungi occur at the same, identical time, as was the case with the inoculation of the test tubes. One or the other, tubercle bacilli or fungi, would be expected to have had prior existence for weeks, months, or years, in the lung tissues, and to have become firmly engrafted with their pathological processes before the other one infected the individual.

One might reasonably expect biochemical interchanges to be produced when pathogenic fungi and tubercle bacilli both infect the pulmonary tissues. Tubercle bacilli usually become less virulent, and assume a less active and invasive state after residing within the lung tissues for varying periods of time. This lessened activity is dependent upon such factors as the initial virulence of the tubercle bacillus and its reaction to general bodily resistance, the acquired localizing tissue defense mechanisms and systemic immunologic developments, as well as the lessened nutrition for the bacilli within the tissues which may partly or wholly encapsulate them. Such bacilli, deprived of an adequate, or balanced nutrition are less capable of multiplying because their limited intracellular reserve foodstuffs are thereby diminished. As a consequence there will be a marked reduction in the metabolic activities of the tubercle bacilli. It has been proved that inactive, or resting, bacteria regain their catabolic activities when any substance, normally utilized in their catabolism, is rendered available to them. The possibility that the mycelial fungi, especially, may supply nitrogen, at least is suggested by our knowledge of the effects of certain mycelial fungi in the metabolism, life history, and successful development of higher plants. Mycelial fungi grow in and on the roots of many of these plants, the legumes, for example are furnished available nitrogen by this means. The fungus mycelium may also serve to increase the decomposition of the infected tissues, thereby the cytoplasmic resistance to the inroads of the tuberculous infection is decreased. The highly speculative nature of these remarks is apparent to me. They are advanced as ideas of no definite value perhaps and solely for their importance in bringing about a more plausible explanation from your discussion of this problem.

In some cases of pulmonary mycoses the pathology closely resembles tuberculosis. Surrounding the fungus infection there is usually tissue destruction and softening, an accumulation of leucocytes, and the formation of pus. The abscesses become surrounded with a dense layer of new fibrous tissue, infiltrated with mononuclear leucocytes, and sometimes containing giant cells. This is interesting to note, even though no relationship is suggested, when we remember the frequently observed similarity in the clinical courses of chronic pulmonary tuberculosis and pulmonary mycoses.

Previous Personal Observations

In a former paper,² written with Dr H N Gemoets, our findings were reviewed of an investigation of 301 consecutive admissions to the Houston Tuberculosis Hospital. The object of the survey was to determine the degree, if any, of association of mycotic infections in tuberculous patients. Two hundred and ninety-five of the patients were definitely tuberculous, the remaining 6 cases were repeatedly sputum negative for acid-fast bacilli. In 45 patients of the total number (301) we isolated fungi from the expectorated sputum, but in only 18 cases did we obtain the fungi by means of an intratracheal aspiration. The remaining 27 cases, comprising the group in which we were unable to recover the fungi from the trachea, were excluded from our study because of the likelihood of the fungi, obtained from the mouth, being saprophytic. The fungi from the 18 patients were subjected to intensive studies, including injection into the lungs of rabbits. In every one of the cases pathological changes were noted in the lung tissues of the inoculated rabbits, and the identical fungus was recovered, again, by culture. We believe we were justified in deciding that these fungi were pathogenic. The larger number of these fungi were filamentous in type. We were greatly surprised at the remarkably short period of time elapsing between the inception of clinical symptoms in these patients and the development of advanced pulmonary disease. In 8 (77 per cent) of our 12 proved tuberculous patients the average time since the onset of their primary clinical symptoms was just 9.6 months. However, in this short period the lung changes had become far advanced. We suspected there was some cooperative influence at work to bring about such devastating changes in less than 10 months duration of known symptoms of sickness.

SUMMARY

An attempt has been made to discuss the commensal relationship between fungus and tuberculous infections of the lungs. The

coexistence of these two infections produces a more rapidly fatal issue in tuberculous individuals than one should expect from a consideration of the duration of the disease process in the lungs. Fungi from the expectorated sputum are usually saprophytic. It is safest to obtain the sputum specimens by intratracheal aspiration, and subject the fungus to animal inoculation, if there is any doubt regarding its pathogenicity.

Physicians should search diligently for coexisting pathogenic fungi in every tuberculous patient whose clinical course is unusually rapid or prone to relapse. The fact that 16 per cent (5 patients) of our clinically diagnosed tuberculous patients harbored pathogenic fungi in their tracheal excretions, although tubercle bacilli were never recovered from these 5 patients, should be remembered. The mycelial fungi are found more frequently than yeast-like fungi as the etiologic agents of pulmonary mycoses, associated with pulmonary tuberculosis. The close phylogenetical relationship of the mycobacterium tuberculosis to certain fungi, the actinomyces, and the frequently noted similar pathological changes in mycotic and tuberculous disease of the lungs are of interest. All ideas dealing with the cooperative relationship between the tubercle bacilli and fungi existing together in diseased tissues are highly speculative, as little, if anything, is known regarding such interacting or interplaying processes. Our investigations would suggest, in a limited number of cases, that the association of a fungus infection of the lungs in a patient having pulmonary tuberculosis would augment and accelerate the activity of the tubercle bacilli, either directly or by lowering the vitality and resistance of the patient to the end that a more unfavorable course of the tuberculous disease, marked by relapses and relatively rapid progression, may be observed. It is suggested that there is some factor present in this interplay of two coexisting infectious diseases, some prototaxic or symbiotic influences, which causes an added infection of the lungs with pathogenic fungi to increase the ravages of pulmonary tuberculosis.

RESUMEN

Se ha intentado discutir las vinculaciones entre las infecciones fúngicas y tuberculosas de los pulmones. La coexistencia de estas dos infecciones en individuos tuberculosos produce un desenlace más rápidamente fatal de lo que uno esperaría tomando por base la duración del proceso morboso en los pulmones. Los hongos obtenidos en el esputo expectorado generalmente son saprofitos. Es mejor obtener los especímenes de esputo mediante la aspiración intratraqueal e inocular los hongos en animales si existe alguna duda en cuanto a su patogenicidad.

Los médicos deben buscar asiduamente hongos patógenos coexistentes en todo paciente tuberculoso cuyo curso clínico es excepcionalmente rápido o propenso a recaídas. Debe recordarse el hecho de que el 16 por ciento (5 pacientes) de nuestros pacientes tuberculosos diagnosticados clínicamente tenían hongos patógenos en sus excreciones traqueales, aunque nunca se pudo encontrar bacilos tuberculosos en estos 5 pacientes. Se encuentran más frecuentemente los hongos micelianos que los hongos parecidos a la levadura, como agentes etiológicos de micosis pulmonares asociadas con tuberculosis pulmonar. La estrecha relación filogenética entre el microbacterio tuberculosis y ciertos hongos, los actinomicetos, y las alteraciones patológicas semejantes, frecuentemente encontradas en enfermedades micóticas y tuberculosas de los pulmones, son de mucho interés. Todas las ideas tocantes a la relación cooperativa entre el bacilo tuberculoso y los hongos, cuando existen juntos en tejidos patológicos, son altamente especulativas, ya que poco o nada se sabe de la acción recíproca de tales procesos. En un número limitado de casos, nuestra investigación indica que la asociación de una infección fungica de los pulmones en un paciente con tuberculosis pulmonar aumenta y acelera la actividad del bacilo tuberculoso, ya directamente o reduciendo la vitalidad y resistencia del paciente, de tal manera que se observa un curso más desfavorable de la tuberculosis, caracterizada por recaídas y un progreso relativamente rápido. Se sugiere que en esta acción recíproca de dos enfermedades infecciosas coexistentes existe algún factor, alguna influencia protóxica o simbiótica, que causa que una superimpuesta infección de los pulmones con hongos patógenos aumente los estragos de la tuberculosis pulmonar.

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Multiple Simultaneous Acute Putrid Lung Abscesses

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Putrid lung abscess is usually due to the aspiration and lodgement of infected particulate matter in the bronchial tree.

In virtually all cases, a solitary abscess occurs. It is a rarity for more than one abscess to develop simultaneously, either unilaterally or bilaterally. Theoretically, multiple abscesses are likely to be produced by marked flooding of the bronchial tree, such as in submersion.

Multiple hematogenous putrid pulmonary abscesses may ensue during septicemia, due to anaerobic organisms, but the fatal outcome of these patients is so rapid, their clinical course is quite different from that of the aspiratory type of abscess.

Ordinarily, the etiological factor in the development of a putrid lung abscess can be ascertained by eliciting a careful history. The mechanism producing such an abscess usually occurs during a general anaesthesia, unconsciousness due to any cause, or during operations upon the mouth, nose, or throat. That aspiration can take place during sleep has also been recognized clinically. Therefore, when a definite causative factor cannot be obtained, the presence of carious teeth, pyorrhoea, periodontal pockets, or infected tonsillar crypts may be considered as the source of the aspirated material. The patient presented here had many carious teeth and a severe pyorrhoea with many pockets containing foul-smelling material.

Pulmonary infarction with later superimposed anaerobic infection may be the factor in the production of a putrid pulmonary abscess. However, when one considers the large number of pulmonary infarctions seen clinically and the very small number of these that develop into abscesses, it must be realized that a putrid lung abscess produced in this manner is indeed a rare occurrence.

During the course of an acute putrid lung abscess, one seldom finds either local or bronchogenic spread during the first six weeks. Therefore, when three separate lesions are found within ten days of the onset of the illness, one can assume that they have occurred simultaneously. Further corroborative evidence for

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FIGURE 1

Fig 1 Hydro-pneumothorax at the right base, shadow in the right upper lobe, circular infiltration in the left upper lobe
Fig 2 Empyema drained, right upper lobe shadow denser, left upper lobe infiltration still present — *Fig 3* Fluid level in the right upper lobe, rarefaction in the left upper lobe

FIGURE 2

FIGURE 3

this pathogenesis in the case reported here is that the patient had only a nonproductive cough during this period. This would virtually eliminate the possibility of a bronchial spread.

The presence of intermittent auricular fibrillation in this patient raises the question of the possibility of multiple pulmonary infarctions with later anaerobic infection. The x-ray findings, however, were in no way suggestive of infarctions, the patient had no pain until perforation into the pleura had occurred, and there was no hemoptysis. Furthermore, there had been no previous history suggestive of infarction, nor any later.

Because of the fact that this patient resided with his son-in-law, a physician, one can assume that the development of these putrid abscesses was asymptomatic. "Surprise putrid empyema" has been described by Neuhof and Stats.¹

The different clinical courses of these three separate lesions ran the gamut of the clinical behavior of an acute putrid lung abscess. One healed spontaneously, another perforated, producing a putrid pyopneumothorax, and the third required surgical drainage.

CASE REPORT

A. D., No 34223. A white male, 60 years of age, was admitted to the Private Pavilion of Montefiore Hospital on December 27, 1941. The history was obtained from his son-in-law, a physician, with whom he resided.

Past History. The patient was a mild hypertensive (170/90) for the past two years. He was known to have had a mild diabetes of many years' duration. He had never taken insulin. On a number of occasions he had had auricular fibrillation which usually responded rapidly to digitalis.

Present Illness. Six days before admission, the patient had a cough, with fever up to 100.5 F. Three days later, his heart began to fibrillate and this continued intermittently up to the time of admission. At the same time, he complained of pain in the right lower chest, and for the last 48 hours he had intractable hiccough.

Physical Examination. An elderly male, with persistent hiccough. The teeth were in very poor condition; there were many caries, considerable pyorrhoea, and pockets containing foul-smelling detritus.

Examination of the chest revealed dull percussion note over the right chest posteriorly. Blood pressure was 170/90. Urine showed 2 plus sugar with no acetone. Hemoglobin was 16 gm. RBC 5,900,000. WBC 20,000. Polynuclears 85 per cent. Blood sugar was 176 mgm per cent.

X-ray examination performed on December 30, 1941 (Fig 1) showed a hydropneumothorax at the right base posteriorly, a shadow in the anterior axillary part of the right upper lobe, and a small circular infiltration in the left upper lobe at the level of the anterior end of the second rib.

Aspiration of the right pleural cavity yielded thick foul-smelling pus. A diagnosis of putrid pyopneumothorax due to a ruptured putrid lung abscess was made. An operation was performed immediately.

Under local anaesthesia, liberal sections of the 8th and 9th ribs were removed. A bilocular empyema cavity containing considerable foul-smelling pus and fibrin was entered. It was situated directly upon the diaphragm, and the posterior loculation extended upward to the apex of the lower lobe, near the mediastinum. In this region, the ruptured pulmonary abscess was found. It was partly covered by a roof of necrotic pulmonary tissue. The empyema cavity was cleared of all debris and exudate, the roof of the lung abscess was excised widely, thoroughly exposing the interior. The pulmonary abscess and empyema cavity were tightly packed with gauze. Smear of the pus showed gram-positive bacilli and gram-positive cocci in long and short chains. Culture yielded *Streptococcus viridans*.

Following operation, the patient became quite disoriented, but his general condition remained good. Glycosuria persisted without evidence of acidosis. The first dressing of the pulmonary-pleural cavity showed marked clearing of the infection, with no retention.

X-ray examination on January 9, 1942 (Fig. 2) showed clearing and diminution in size of the empyema cavity. The small infiltration in the left upper lobe was fainter and the shadow in the right upper lobe was denser and more localized. A subsequent examination on January 14th (Fig. 3) showed further improvement in the empyema cavity, an area of rarefaction in the left upper lobe infiltration, and a fluid level in the extreme anterior axillary part of the right upper lobe. This was so close to the thoracic wall that it suggested the presence of a perforation of another abscess with a pyopneumothorax.

The patient was taken to the operating room on January 14, 1942 and a segment of the right second rib in the anterior axillary line was removed. The pleura was found to be thickened, and aspirations yielded foul-smelling pus. A large putrid lung abscess was entered. There were a number of small loculations. The entire roof of the abscess was removed and the cavity packed.



FIGURE 4



FIGURE 5

Fig. 4 Clearing of the empyema cavity and right upper lobe operative area, left upper lobe abscess smaller—Fig. 5 Disappearance of left upper lobe lesion and continued clearing of the right hemithorax

Following this operation, the general condition of the patient steadily improved, the mental confusion disappeared, and the urine became negative for sugar. Both wounds cleared up quickly and the bronchial fistulas, present in both, closed rapidly. An x-ray examination on January 27, 1942 (Fig 4) showed continued improvement in the empyema cavity, a clearing of the right upper lobe operative area, and beginning disappearance of the left upper lobe abscess.

Both wounds healed rapidly and an x-ray examination on February 25, 1942 (Fig 5) showed the disappearance of the left upper lobe infiltration and practically complete return to normal of the right hemithorax. The patient was discharged on February 26, 1942. Follow-up examination a number of months later showed normal pulmonary fields on fluoroscopic examination, and the patient had no symptoms referable to his respiratory system.

He remained in good health until 1946 when he was re-admitted to the hospital with a benign hypertrophy of the prostate. He died on August 6, 1946, following transurethral resection. No permission for post-mortem examination was obtained.

SUMMARY

Multiple simultaneous acute putrid lung abscesses are a rare clinical occurrence.

A case is reported in which three distinctly separate acute putrid lung abscesses appeared within a week of onset of symptoms.

The etiological factor was aspiration of infected particulate matter from the mouth.

Each abscess behaved differently—one perforated, causing a localized putrid pyopneumothorax which was drained, another disappeared spontaneously, and the third was treated by surgical drainage.

A complete cure was obtained.

RESUMEN

Los abscesos pulmonares putridos agudos multiples y simultáneos son de rara ocurrencia clínica.

Se informa sobre un caso en el que tres abscesos pulmonares putridos agudos, completamente separados, aparecieron en la semana de la iniciación de los síntomas.

El factor etiológico fue la aspiración de materia infectada proveniente de la boca.

Cada uno de los abscesos reaccionó diferentemente: uno se perforó y causó un pnoneumotórax putrido localizado que fue canalizado, otro desapareció espontáneamente y el tercero fue tratado por canalización quirúrgica.

Se logró la completa curación.

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Tuberculosis in Pediatric Practice

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Optimism over the complete eradication of tuberculosis as a major cause of illness and death in the United States seems justified. Some estimate that this goal may be reached in as short a time as a generation or two. Should a drug such as streptomycin, in the meantime prove out to be effective against the disease, the time would of course be shortened.

A glance at recent statistics gives the basis for such optimism. In 1944 the tuberculosis mortality rate was 41.3 for all forms of tuberculosis, and if the pulmonary type alone is considered the rate was only 38.3. Contrast this with the rate of 201.9 deaths per 100,000 population for the U. S. Registration Area in 1900. Tuberculosis now occupies seventh place in the list of causes of death instead of first place where it stood for so many years. While it was once held that tuberculous infection after the tenth year of life was practically universal, it is now probable that considerably less than one-half of the adult population reacts positively to tuberculin, and the proportion of young persons reaching adult life with negative tests is steadily growing. The Committee on Tuberculosis of the American Student Health Association reported for the year 1942-43 that among 208 colleges and universities representing a total student enrollment of 300,144, the incidence of positive reactors was 18.6 per cent. In some rural schools in the Middle West as few as six to ten per cent of the children react positively to the tuberculin test. Indeed, in one four-county sanatorium district in Minnesota in 1946, out of 240 schools surveyed not a single reactor was found in 183 of them. When a similar result has been achieved for a majority of the counties of the nation the conquest of human tuberculosis will have become as successful as has the conquest of bovine tuberculosis by the veterinarians.

But in spite of these encouraging indications a monumental task yet remains to be accomplished. Great progress was made during the war when millions of young men were examined for tuberculosis by roentgenograms of the chest. This important work is being carried on throughout the country among the civilian population by means of mobile x-ray units using micro-film. The objective of course, is to locate persons harboring tuberculous disease so that they may be isolated and brought under treatment.

at the earliest possible moment. The purpose of this article is to stress the contribution physicians, in their every day practices among children, can make in this final concerted drive against one of the worst scourges of mankind. In the following paragraphs diagnostic tuberculin, pathogenesis of the common forms of tuberculosis encountered in children, and their diagnosis, prognosis, prevention and treatment are discussed.

In diagnostic tuberculin the physician has at his disposal one of the most specific of all the specific tests available for the detection of disease. It should be used as routinely in one's daily practice to exclude tuberculosis as is the Wassermann or a similar test to exclude syphilis, or tests of the urine for sugar and albumin to exclude diabetes and nephritis, or the agglutination tests for typhoid or Malta fever. Negative tests may be as significant as positive tests. Recently a ten year old girl was under observation because of a lesion of her lower thoracic spine of many months duration which had resulted in a kyphosis. X-ray films were interpreted by the roentgenologist and orthopedist as tuberculous spondylitis. However, her tuberculin test, even with five milligrams of O.T., was consistently negative. Operation became necessary because of pressure on her spinal cord. Examination of material removed proved the lesion to be due to an osteogenic sarcoma. Repeated experiences such as this over a good many years have led me to be extremely reluctant to accept any lesion as tuberculous, however suspicious, when properly performed tuberculin tests with reliable materials are negative.

True, there are a few exceptions in which tuberculin tests may react negatively even when a tuberculous infection exists. These may be enumerated as follows: first, in the pre-allergic period, that is, after infection occurs but before allergy develops, second, during certain of the acute communicable diseases, such as whooping cough, measles, scarlet fever, and diphtheria, third, when the tuberculous lesions have become completely healed (no viable bacilli) so that no tuberculoprotein reaches the circulation, and fourth, when overwhelming tuberculous disease depresses tissue reactivity to a state of anergy. With these few exceptions the tuberculin test may be accepted as providing a very efficient method for sifting out those who have not been so infected. Furthermore, a negative test in a child offers the strong probability that the members of his family with whom he is in close contact are also free from tuberculous disease, at least in a communicable form.

In evaluating the meaning of a positive reaction to tuberculin, one must remember that sensitivity of all the tissues of the body results within a few weeks following the establishment of the

primary infection. Since allergy thus created continues in the majority of individuals throughout life, it follows that a positive reaction at any age denotes only that a primary infection has taken place. Its diagnostic implications, therefore, extend no further than this. For location, extent, activity and stage in the evolutionary course of the disease, other methods of study must be undertaken. Furthermore, no significant correlation exists between the size of the reacting area and the amount of activity of the tuberculous disease present.

However, a positive reaction to tuberculin is significant in several other respects. In the first place, it means that the child has at some time been in contact either with a human or bovine source of infection. Herein lies one of the most important contributions the pediatrician or the general practitioner can make in the conquest of tuberculosis. By doing routine tuberculin tests on his child patients, the physician may be able to uncover an hitherto unsuspected source of contagion. The younger the child who shows up with a positive test the more likely it is that the source of the tubercle bacilli is someone in the immediate family. Old persons with chronic coughs should particularly come under suspicion, but the job is not done until every member of the family as well as other possible sources have been investigated for tuberculosis. The grave importance of locating the spreader of tubercle bacilli is too well known to need further comment. But that the child with a positive tuberculin test can frequently lead to the detection of an open case of tuberculosis is a fact not taken advantage of as frequently as it should be. Finally a positive test in a child identifies the individual who must be kept under observation for the possible development of chronic pulmonary tuberculosis at some future date. This form of tuberculosis rarely makes its appearance before the age of puberty, but knowledge of pre-existing sensitivity to tuberculin at or before this time singles out those who should have yearly chest roentgenograms, not only during the teen age period when the incidence of pulmonary disease is high, particularly in girls, but for years afterwards. It is conservatively estimated that one out of every ten children with a positive reaction sooner or later develops chronic pulmonary tuberculosis. Here again the physician in private practice has a real responsibility for detecting this form of tuberculosis at its very beginning, before the patient has become a spreader of organisms and while treatment is promising and relatively simple. Such early recognition is possible only by roentgenography. Early diagnosis based upon symptoms and physical findings invariably means for advanced tuberculosis. A passing thought which might be recorded here is that if the present vogue of x-raying chests of children

with miniature films leads to a decrease in the use of diagnostic tuberculin much information of value in the control of tuberculosis will be lost

Pathogenetic Development of Tuberculosis

Tuberculosis is essentially a biphasic disease consisting of primary and reinfection phases. The primary phase most frequently occurs in childhood, and formerly was referred to as "childhood type of tuberculosis." However, it also occurs in adults and with increasing frequency in recent years for the simple reason that fewer children are being infected. The term reinfection phase has supplanted the older term of adult type of tuberculosis, largely for the reason that while it most commonly occurs in adults it may also occur in children. There are certain fundamental differences between these two phases.

Primary Tuberculosis

- 1 Organism seeded on nonallergic tissues
- 2 Progression occurs readily via lymphatics to regional lymph nodes
- 3 Spread by lymphohematogenous route characteristic
- 4 Marked tendency for lesions to recede and calcify
- 5 As a rule evidences of illness are slight.

Reinfection Tuberculosis

- 1 Organisms seeded on allergic tissues
- 2 Little tendency for involvement of regional lymph nodes
- 3 Chief method of spread is by contiguity and bronchogenic
- 4 Tendency for lesions to progress to cavitate and to spread.
- 5 Accounts for practically all of major morbidity and mortality from tuberculosis

The precise definition of these two phases is still a matter of controversy. Myers is the chief exponent of the view which restricts the definition of the primary phase to include only the lesions set up as the direct result of the initial infection in the period before allergy becomes established. Any new set of tuberculous lesions occurring subsequent to the development of allergy and outside of the original lesions is considered as belonging to the reinfection phase. Diagnostic Standards for 1940, on the other hand, defines the primary phase as including all forms of tuberculosis which follow directly and uninterruptedly the first implantation of tubercle bacilli. Thus, tuberculous pneumonia, miliary tuberculosis, and tuberculosis meningitis are classified as belonging to the primary phase, whereas in Myers' conception these are classified as acute reinfection forms. The essential difference in these points of view would seem to be largely in their prognostic implication. Myers considers primary tuberculosis as a routinely benign disease, but it cannot be regarded as such, particularly in young children if one accepts the definition advanced by Diagnostic Standards.

While primary infections may occur in the abdomen, in the cervical region, or in the skin, by far the commonest route (over 90 per cent) is by way of the respiratory tract. The first effect of inhalation of virulent tubercle bacilli is the establishment of single or multiple foci of tuberculous pneumonia in some part of the lung, usually close beneath the pleura. Bacilli multiply here and are carried by the lymphatics to one or more of the regional broncho-pulmonary lymph nodes. The pulmonary focus and lymph node focus together constitute the "primary complex" of Ranke.

Allergy becomes established within two to seven weeks from the time of the initial infection. Subsequently the lesions of the primary complex usually undergo a process of gradual retrogression, encapsulation, calcification, and occasionally ossification. Viable tubercle bacilli may remain locked up in these calcified foci for months, years or even the life time of the individual. The complete developmental course of the primary phase most frequently runs its entire course without the knowledge of the patient, family or physician. In approximately three-fourths of children who have undergone this experience the only residual evidence is a positive tuberculin reaction. Of the remaining twenty-five per cent the majority will show in the x-ray film characteristic calcified foci either in the lung parenchyma, hilus nodes, or both.

Occasionally, and most often in young children and those known to have been exposed, the lesions of the primary infection may be detected by the x-ray in the early or fresh state. In such cases symptoms and slight physical findings may be present. The most important symptom appearing at this time is fever. It usually begins coincidentally with the development of allergy and continues for a week, a month or even longer. However, there is little to distinguish this fever from that occurring in ordinary acute infections so that its significance is frequently not realized unless a positive tuberculin reaction raises the possibility. Temporarily the fever may be accompanied by lassitude, anorexia and failure to gain weight, but on the whole the evidences of illness are slight. Physical findings are usually meager or absent altogether, even when rather prominent pneumonic shadows are revealed in the x-ray film. Occasionally, however, a few rales or changes in breath sounds may be elicited over the involved area.

The cause of these pneumonic shadows has been the subject of some debate. Eliasberg and Neuland in 1920 employed the term "epituberculosis" to describe them in the belief that although they occurred in tuberculin sensitive children, they were of a non-tuberculous nature. More recently the suggestions have been advanced that they represent atelectatic areas due to obstruction of a bronchus from lymph node pressure or to obstruction from

allergic swelling of the mucous membrane inside the bronchus. The prevailing view, however, favors the belief that the cause of these shadows is an allergic inflammatory reaction about a tuberculous nodule and its surrounding zone of tubercles. The further course of these pneumonic infiltrations is usually one of slow retrogression over weeks and months, the densities often persisting long after symptoms and physical findings have subsided. Central caseation probably occurs in most of them, but rarely are cavities demonstrated by x-ray. The eventual outcome is one of slow resolution, either to complete disappearance of the lesions, to a few fibrous strands along the course of the lymphatic channels leading to the lymph node component, or to calcified deposits (Ghon tubercles) in the caseous centers.

While hilus gland tuberculosis is invariably associated with the pulmonary component of the primary complex, at times it may appear to be present alone. The tuberculous lesions exist in the nodes as caseous, partly caseous and calcified, or calcified. Occasionally, the caseous stage is considerably prolonged, but as a general rule, encapsulation, resolution and calcification more or less parallel similar changes in the pulmonary focus. In the majority of instances, the caseous nodes are not sufficiently enlarged to be visualized in the x-ray film. Symptoms are either absent or of such a mild general character that no specific significance can be attached to them, and even if the tuberculin reaction is positive, a definite diagnosis cannot be reached until serial x-ray studies reveal the beginning deposition of calcium. With a further increase in severity, some of the nodes may protrude beyond the margins of the mediastinum and become demonstrable in the x-ray film as characteristic rounded knobs. In this stage, fever, anorexia, anemia, hoarseness, and a bitonal cough may or may not be present.

Rarely, and again usually in the early years of childhood, massive enlargement of the mediastinal nodes literally chokes the whole area in the vicinity of the root of the lung resulting in compression of the bronchi, trachea, esophagus, blood vessels or nerves. Under such circumstances, severe and alarming symptoms may develop. The usual course of hilus gland tuberculosis, however, is one of healing by resolution and calcification over a period of from six months to two or three years.

Again, and most often in infants and young children where the opportunities for massive doses of bacilli are greatest, the lesions of the primary complex may not promptly retrogress, but on the other hand may undergo progression and extension. Thus, progress may occur at the site of the primary pulmonary infiltration by contiguity, leading sometimes to a large excavating pneumonia. Severe toxic symptoms may develop in which cough, cyanosis,

irregular and persistent fever, loss of weight, anemia, prostration and rapid pulse predominate Hemoptysis may occur Physical findings of extensive dullness, tubular breathing and rales are readily obtainable over the involved area Sputum obtained by gagging or stomach washings contains tubercle bacilli in large numbers For many weeks or months, there may be grave doubt as to whether one is dealing with a lesion which will eventually resolve and calcify or one which will progress and result in death

Ulceration of a cavity or a caseous lymph node into a bronchus with aspiration of large numbers of tubercle bacilli into the lung results in acute tuberculous pneumonia

Tuberculous pneumonia, unlike primary pulmonary infiltrations, tends to progress, to spread, to cavitate and to be attended by grave symptoms of illness At first, the disease may be unilateral, but as a rule the other lung before long becomes involved through transbronchial spread The onset of the symptoms may be acute, simulating non-tuberculous pneumonia, or it may be more gradual In either case, the picture shortly is one of severe prostration with fever, cough, dyspnoea, cyanosis, and rapid failure predominating Hemorrhage may occur as the result of rupture of a blood vessel into a cavity Physical findings are usually positive, resembling those of ordinary pneumonias with the possible exception that they may not be as extensive as one would expect from the roentgenographic picture The disease is to be differentiated chiefly from the acute pneumonias, and from large primary pulmonary infiltrations In respect to the latter, one may be in doubt for sometime, but the x-ray evidence of spreading lesions, particularly when they appear in the opposite lung, usually serves to make the distinction Collapse therapy may be indicated in this form of tuberculosis

Progress from the primary lesions by way of the lympho-hematogenous route is of considerable significance During the pre and post-allergic period tubercle bacilli may reach the general circulation in dosages of varying degrees Transported by the blood the bacilli may cause single or multiple lesions in the lungs, meninges, bones, kidneys, skin and other organs If the dosage is not too great, such foci usually become encapsulated and remain quiescent, but always as potential sources of clinical disease at some future time When overwhelming invasion of the circulation occurs, as from rupture of a caseous node directly into a large blood vessel, the result is miliary tuberculosis, generalized or pulmonary, a complication few children survive Until recently the pathogenesis of tuberculous meningitis was generally regarded as being similar to that of miliary tuberculosis in that tubercle bacilli were carried directly to the meninges via the blood stream

from a focus in the tracheobronchial lymph nodes Rich and McCordock, however, have presented convincing evidence that this is not the case Miliary tuberculosis apparently sets up caseous foci in the substance of the brain, cord, meninges, choroid plexus or in the bones encasing the central nervous system It is the rupture of one or more of these older caseous foci, permitting the discharge of bacilli directly into the cerebrospinal fluid which originates diffuse tuberculous meningitis This view is supported by the fact that generalized miliary tuberculosis and diffuse tuberculous meningitis occur independently Furthermore, the experimental injection of large numbers of virulent tubercle bacilli into the carotid artery produces occasional sparsely located meningeal tubercles rather than diffuse tuberculous meningitis

It is probable that from ten to twenty-five per cent of all children who acquire a primary tuberculous infection subsequently develop reinfection tuberculosis of the chronic pulmonary type Only rarely does it develop in children before the tenth year of life, but it appears with increasing frequency during adolescence and reaches its maximum incidence between eighteen and thirty to thirty-five years

The time interval elapsing between the initial phase of the primary infection and the first development of the reinfection pulmonary disease may be many months or years, or the interval may be so brief that one appears to be practically continuous with the other The former is likely to be the situation when the primary infection occurs sometime during childhood, but before puberty, while the latter more often obtains when the primary infection takes place in adolescence or in young adult life No certain explanation exists for the unusual freedom which children between the ages of infancy and adolescence seem to enjoy from phthisical forms of tuberculosis It has been suggested that it is due to the long period of time necessary for tuberculosis to develop into clinical disease in the human body, and that a similar course occurs in the young of animals and fowl Also, it is likely that the increased need for minerals and proteins and other metabolic changes which occur in adolescence in association with the establishment of menses as reported by Johnson have a significant bearing upon the development of tuberculosis in puberty and upon its more frequent occurrence in adolescent girls

The tubercle bacilli responsible for pulmonary tuberculosis may originate from exogenous or endogenous sources Possible endogenous sources are the lesions of the primary complex from which bacilli may escape, or a pulmonary lesion laid down during the pre or post-allergic lympho-hematogenous spread may light up Whatever the source, the earliest lesions consist of small areas

of lobular pneumonia usually from one to three centimeters in diameter, which in the x-ray film appear as soft mottled shadows most frequently located in the subapical region. Usually a single focus, most often in the right lung, occurs, but multiple foci may be present. The ultimate fate of these early infiltrates may be in doubt for several months or even years. Some retrogress and heal by fibrous encapsulation, resorption or occasionally by calcification. Others undergo a slow process of progression by contiguity, central caseation, liquifaction and cavity formation.

Diagnosis of chronic pulmonary tuberculosis in its earliest incipient stages can be made only by x-ray. It is important, therefore, that tuberculin sensitive children should have annual x-ray films made of the lungs from the age of puberty on. The detection of the characteristic soft mottled apical shadow of the early infiltrate calls for a most careful period of observation. Once the tuberculous nature of the lesion has become established and evidence of progression obtained specific treatment is indicated. In the majority of cases this will take the form of some type of collapse therapy.

Diagnosis

Diagnostic tuberculin and the x-ray constitute the bulwarks upon which chief dependence is placed for the diagnosis of the various forms of tuberculous disease occurring in childhood.

History of exposure, symptoms of illness and physical findings are relatively poor diagnostic guide posts. Among those who are known to have been exposed to an open case of tuberculosis it may be expected that the proportion found to be infected will be much greater than where no such history is obtained. On the other hand, active tuberculosis in a communicable stage is not infrequently present in some adult member of the family, or close associate of the child, entirely unsuspected. Unfortunately, the symptomatology of tuberculosis is not pathognomonic with the possible exception of the advanced stages of some of the reinfection forms. The transitory fever which accompanies the acute phase of some primary infections is easily overlooked, or if it is noted, is ascribed to nonspecific infections of the respiratory tract. A similar situation exists with respect to physical findings.

Nevertheless, a careful physical examination is not to be neglected since it may be of great importance in the differential consideration of nontuberculous disease. In this respect, one should remember that positive physical findings obtained over the lungs, such as rales and changes in breath sounds in the percussion note, are in the vast majority of instances due to conditions other than tuberculosis. Underweight, poorly nourished children are no more susceptible to tuberculous infections than are their robust asso-

ciates While children who are known to have been exposed to open cases of tuberculosis, and those who present symptoms or physical signs of illness, form an obvious group in which investigation for tuberculosis is clearly indicated, nevertheless, restriction of case finding, even in private practice, to such children will inevitably result in failure to discover the major portion of infected children The routine use of diagnostic tuberculin for children of all ages, with retesting of the negative reactors at least every three years is a practicable program

For determining the location and extent, and for following the course of tuberculous lesions, the roentgenogram or fluoroscope is indispensable In general, the child who is discovered to react positively to tuberculin should have at least one x-ray film of his chest at that time Experience has shown that further x-ray study may, in the vast majority of instances, safely be postponed until the tenth year of life

Demonstration of tubercle bacilli is desirable whenever possible since it clinches a previously suspected diagnosis Because of the habit most young children have of swallowing their sputum, the usual method of sputum examination as employed in older children and in adults is successful only occasionally when sputum can be obtained by gagging on a swab or on the end of a tongue blade However, it has been shown that tubercle bacilli may be recovered from the stomach contents or in the feces of a fair proportion of children with primary intrathoracic tuberculosis As might be expected, positive results are most frequently obtained in the younger patients Within six to eight months after the initial primary infection, there is a marked tendency for the stomach contents to become negative, indicating that this is the length of time required for closing of the primary foci What public health liability there is from children with primary infections would seem to be largely confined to this relatively brief period during which the lesions are in a "fresh" stage

The technic of obtaining gastric contents for examination consists of washing the stomach with two to three hundred cubic centimeters of sterile water in the morning after a fast of six hours The material is centrifuged, the sediment homogenized and a stained smear is examined If negative, cultures are made and animal inoculation carried out Similarly, material obtained from other suspected sources such as pleural effusion ascitic fluid, cerebrospinal fluid and cold abscesses should be examined

Studies of the blood, including the hemogram, sedimentation rate and Schilling differential count, are of less value in the diagnosis of tuberculous infections in children than in estimating prognosis and the favorable or unfavorable course of the disease

It is important to keep in mind the variations which normally occur in different age periods between lymphocytes, monocytes and leukocytes. No significant changes are noted in the total leukocyte count or in the differential smear in any of the stages of primary tuberculosis, including the acute inflammatory stage. In cases of reinfection tuberculosis an increase in the total leukocyte count is suggestive of secondary infection, a relative increase of monocytes over lymphocytes (M:L ratio) is indicative of activity and progression of the tuberculous disease, the reverse of these relationships occurs with resolution and healing, and a shift to the left in the Schilling count is evidence of increased toxicity, the greater the shift the more serious the prognosis. Likewise repeated determinations of the sedimentation rate of the red cells may be useful in estimating the activity of the tuberculous process and in following its course.

Prognosis

The immediate prognosis of all primary tuberculous infections is good with the exception of infections occurring during the first five years of life, particularly during the first two years. In this age period the prognosis is considerably worse for colored children than for white children. Approximately ninety per cent of white children infected during the first five years of life may be expected to survive their tuberculous infection. Such mortality as there is from tuberculosis will occur largely in the first two years of life and will occur in the group whose chest roentgenograms show parenchymal lesions. The risk to life is nearly twice as great in infants who acquire their tuberculous infection in the first year of life as in those who do not become infected until the second year. Death is due almost exclusively to the acute reinfection forms of tuberculosis such as meningitis, miliary disease and tuberculous pneumonia which result from the extension of the disease beyond the confines of the primary complex.

The remote prognosis for children who have acquired primary infections during childhood is uncertain. An unknown number (perhaps from ten to twenty per cent of those who enter puberty with positive tuberculin reactions) will fall ill with chronic reinfection pulmonary tuberculosis sometime during adolescence or early adult life. Of this number at least one-fourth will die of their tuberculous disease within the next six years. Whether institution of collapse therapy in the pre-symptomatic minimal stage will greatly alter this poor prognostic outlook in the future remains to be seen. It is very probable that it will

Prevention

The hope of complete eradication of tuberculosis from the human race seems to rest squarely on the basis of its control by epidemiologic means. Already great progress has been made in this direction. Bovine infections have been practically eliminated as a source of danger to infants and children. Protection of children from human infections is, of course, a far more difficult task, but the means are at hand awaiting application only to accomplish it. If a leaf could be borrowed from the methods employed by the veterinarians, the entire population of the nation would periodically be tested by tuberculin, the positive reactors would be x-rayed and studied for clinical disease, and those found to be contagious would be isolated and treated. While such an ideal program has little chance of immediate attainment, it can and is being approached. It is entirely practicable for physicians to provide their child patients with an immediate environment which is safe from the risks of tuberculous infection. A chest roentgenogram and tuberculin test should be as routine in the prenatal care of every woman as is the taking of a blood specimen for syphilis. A similar examination should be made of the members of the family including domestic workers, of school teachers, and of physicians, nurses and other personnel of hospitals caring for children. Repetition of these precautionary measures every two or three years, together with testing of the children themselves with tuberculin at like intervals, constitutes the most effective prophylactic program for children available at the present time.

Further protection for the children of America is being secured by mass x-raying surveys of apparently healthy groups in industry, rural areas, high schools, colleges and other groups. These programs are usually carried on without preliminary tuberculin testing and have as their aim the detection of active or potentially active tuberculous lesions. Miniature films and rapid film taking methods make it possible to examine large numbers of persons quickly and economically.

Treatment

Unfortunately, no specific form of drugs or serum therapy has been developed for tuberculosis. The sulfonamide chemicals apparently are not effective against the tubercle bacillus. Streptomycin is still in the experimental stage. However, it offers the most promise of any of the newer chemicals so far brought forward.

Rest, diet, healthful living conditions and time are the general measures to be depended upon for bringing about healing in most of the tuberculous lesions. The importance of breaking contact with sources of infection as the first step in any form of tuber-

culous disease in a child cannot be overemphasized. The great majority of primary infections need no further treatment than this, plus rest and a well balanced diet for a few months when the lesions are discovered in the acute stage. Sanatorium or preventorium care is unnecessary, although the educational value of such institutions cannot be denied. Their facilities and those of convalescent or foster homes should, however, be utilized when contact with infection cannot be broken in the child's own home. Every precaution should be taken, too, to avoid exposing children with active tuberculous lesions to the acute communicable diseases, including colds and influenza. Ascorbic acid requirements are considerably increased in tuberculosis, hence liberal amounts of this vitamin should be included in the diet. Resumption of normal activities should be gradual, and presaged upon the serial x-ray appearance of lesions, the absence of symptoms, on the sedimentation rate and upon an optimum state of nutrition.

Heliotherapy is indicated in all forms of tuberculosis except active intrathoracic lesions. Exposures should be gradual and should be interdicted if an increase in fever and pulse rate is noted. Sunlight is preferable to artificial sources of ultraviolet rays. Cold or fresh air on open porches has been abandoned in favor of controlled ventilation and moisture content. The field of usefulness of collapse therapy in children is almost entirely confined to the treatment of chronic reinfection pulmonary tuberculosis in puberty and adolescence. However, it may have to be considered occasionally in younger children when cavities or hemorrhages occur in connection with the lesions of massive primary pulmonary tuberculosis or tuberculous pneumonia.

SUMMARY

Complete eradication of tuberculosis as a major cause of illness and death in the United States within the next generation or two is an attainable possibility by application of methods already known. If streptomycin or a similar drug proves efficacious this time would be considerably shortened. In the over-all fight against the disease the physician whose practice deals with children can contribute much in this final drive.

Diagnostic tuberculin is one of the most specific of all the specific tests available for the detection of disease. The physician should use it routinely in his child patients at two to three year intervals. False negative tests occur only rarely. A positive test means only that a primary tuberculous infection has occurred at some previous time. However, the finding of a positive reaction in a child, especially a young child in the first years of life, may be the means of uncovering an hitherto unsuspected source of con-

tagion Furthermore, a positive test in a child identifies the individual who must be kept under observation for the possible development of chronic pulmonary tuberculosis at some future date Mass x-raying the chests of children fails to make this distinction

Knowledge of the pathogenetic development of the various forms of tuberculosis aids the physician in recognizing the stage in the evolutionary course of the disease at which his patient may have arrived There are fundamental differences between primary tuberculosis and reinfection tuberculosis The development of tuberculo-allergy several weeks after the initial infection is responsible for these differences In the majority of children primary tuberculosis is limited to the pneumonic lesion and to the lymph node lesion In a few, extension may occur by contiguity about the pulmonary focus, or by hematogenous or bronchogenic spread from the lymph-node focus Thus accounted for are the acute reinfection forms of tuberculosis such as tuberculous broncho-pneumonia, miliary tuberculosis, and tuberculous meningitis The latter, however, is not the direct result of hematogenous seeding, but rather, results from rupture of an older focus into the sub-arachnoid space

Chronic pulmonary tuberculosis is rarely encountered before puberty No certain explanation exists for the remarkable freedom children between the ages of five and puberty enjoy from tuberculous morbidity and mortality Possible factors having a bearing upon the high infection rate of chronic reinfection tuberculosis, especially in girls, during the teen age are the increased need for minerals and protein and other metabolic changes which occur in adolescence in association with the establishment of menses The reaction of every child to tuberculin should be known at or before the onset of puberty Positive reactors should have, at least annual x-ray films of the lungs made in order to recognize at the earliest possible time, the characteristic soft mottled apical shadows of the early infiltrate

Diagnostic tuberculin and the x-ray constitute the bulwarks upon which chief dependence is placed for the diagnosis of the various forms of tuberculous disease occurring in childhood History of exposure, symptoms of illness and physical findings are relatively poor guide posts Demonstration of tubercle bacilli by gastric lavage is frequently helpful in clinching a previously suspected diagnosis Studies of the blood, including the hemogram, sedimentation rate and Schilling differential count are of less value in diagnosis than in estimating prognosis and the favorable or unfavorable course of the disease

The immediate prognosis of all primary tuberculous infections is good with the exception of the comparatively few children in the first five years of life whose primary complexes extend to the

development of such acute reinfection forms as meningitis, miliary disease and tuberculous pneumonia. The remote prognosis however, is more uncertain, both from the point of view of the number who will ultimately develop chronic pulmonary tuberculosis and the number who will die from this form of the disease.

An environment safe from the risks of tuberculosis infection should be provided every child. In this preventive phase the pediatrician and the physician can accomplish much.

Experiments now being carried on with streptomycin may provide a specific form of therapy, but until its efficacy has been proven, rest, diet, healthful living conditions and time are the general measures to be relied upon for bringing about healing in most of the tuberculous lesions of children. Collapse therapy may occasionally be indicated.

RESUMEN

La completa erradicación de la tuberculosis como causa mayor de enfermedad y de muerte en los Estados Unidos dentro de la próxima generación o la siguiente, es una posibilidad realizable mediante la aplicación de métodos ya conocidos. Si la estreptomycinina u otra droga semejante resulta eficaz, podría ser considerablemente acortado este plazo. En la lucha total contra la enfermedad, el médico que trata a los niños puede contribuir mucho en esta campaña final.

La tuberculina diagnóstica es una de las más específicas de las pruebas específicas disponibles para el descubrimiento de enfermedades. El médico debe usarla sistemáticamente en sus niños enfermos, a intervalos de dos o tres años. Las reacciones negativas falsas ocurren con rareza. Una reacción positiva sólo significa que ha ocurrido una infección tuberculosa primaria en una época previa. Sin embargo, el descubrimiento de una reacción positiva en un niño, especialmente en un niño pequeño, en los primeros años de vida, puede ser el medio de revelar una fuente de contagio hasta entonces no sospechada. Además una prueba positiva en un niño señala al individuo que debe ser observado por el posible desarrollo de tuberculosis pulmonar crónica en una fecha futura. Los exámenes radiográficos colectivos de los pechos de los niños no establece esta distinción.

El conocimiento del desarrollo patógeno de las varias formas de la tuberculosis ayuda al médico a reconocer la etapa en el curso evolutivo de la enfermedad en que el paciente puede encontrarse. Existen diferencias fundamentales entre la tuberculosis primaria y la tuberculosis de reinfección. El desarrollo de la alergia a la tuberculina que ocurre varias semanas después de la infección inicial, es responsable de estas diferencias. En la mayoría de los

niños la tuberculosis primaria está limitada a la lesión neumónica y a la de los ganglios linfáticos. En unos cuantos puede ocurrir una propagación por contigüidad alrededor del foco pulmonar, o una propagación hematógena o broncógena proveniente del foco en el ganglio linfático. Esto explica las formas agudas de la tuberculosis de reinfección, tales como la bronconeumonía tuberculosa, la tuberculosis miliar y la meningitis tuberculosa. Esta última forma, sin embargo, no es el resultado directo de una siembra hematógena, sino que se debe más bien a la ruptura en el espacio subaracnoideo de un foco más antiguo.

Sólo raramente se encuentra la tuberculosis pulmonar crónica antes de la pubertad. No existe una buena explicación de la razón por la cual los niños de los cinco años a la pubertad disfrutan de una extraordinaria inmunidad a la morbilidad y mortalidad tuberculosas. Los posibles factores que tienen que ver con el elevado coeficiente de infección de la tuberculosis de reinfección crónica, especialmente en las niñas de 13 a 19 años, son el aumento en la demanda por minerales y proteínas y otros cambios metabólicos que ocurren en la adolescencia, asociados con el establecimiento de la menstruación. Debe conocerse la reacción a la tuberculina de todo niño durante o antes del comienzo de la pubertad. A los reactores positivos se les deben tomar películas radiográficas de los pulmones por lo menos anualmente, a fin de descubrir lo más temprano posible las suaves y moteadas sombras en el ápice que caracterizan el infiltrado precoz.

La tuberculina diagnóstica y la radiografía constituyen los baluartes en los cuales se debe poner la mayor confianza para el diagnóstico de las varias formas de tuberculosis que ocurren en la niñez. La historia de exposición, los síntomas de enfermedad y los hallazgos físicos, son postes indicadores de relativamente poco valor. La demostración de bacilos tuberculosos por medio del lavado gástrico a menudo ayuda a verificar el diagnóstico previamente sospechado. Los estudios de la sangre, inclusive del hemograma, índice de sedimentación y enumeración diferencial de Schilling, tienen menor valor en el diagnóstico que en calcular el pronóstico y el curso favorable o desfavorable de la enfermedad.

El pronóstico inmediato de todas las infecciones tuberculosas primarias es bueno, con la excepción del comparativamente pequeño número de niños en los primeros cinco años de vida cuyos complejos primarios progresan hasta el desarrollo de tales formas agudas de reinfección, como la meningitis, la enfermedad miliar y la neumonía tuberculosa. El pronóstico remoto, sin embargo, es más incierto tanto desde el punto de vista del número de los que finalmente contraerán tuberculosis pulmonar crónica como del número de los que morirán de esta forma de la enfermedad.

Todo niño debe estar situado en un ambiente en el que se encuentre amparado contra los riesgos de la infección tuberculosa. En esta fase preventiva tanto el pediatra como el médico pueden lograr mucho.

Los experimentos que actualmente se están llevando a cabo con la estreptomyciná podran suministrar una terapia específica, pero hasta cuando se haya comprobado su eficacia, el reposo, la dieta, las condiciones de vida saludables y el tiempo, son las medidas generales de las que se debe depender para promover la curación de la mayor parte de las lesiones tuberculosas en los niños. Ocasionalmente se indica la colapsoterapia.

Silicosis as an Industrial and Compensation Problem in British Columbia*

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Silicosis is an ancient industrial disease long known by various names, e g, "grinder's rot," "potter's asthma," "miner's consumption," all of which indicate its industrial origin and rather hopeless prognosis During the past twenty-five years, due to research work done by numerous scientists in various countries, and the greatly extended use of the x-ray, our knowledge concerning this disease has been widely extended It still presents, however, many problems in its pathology, diagnosis and treatment, which are unsolved

In this paper it is proposed to give, in a more or less dogmatic way, a summary of our present knowledge and a brief account of the methods used in British Columbia in prevention, treatment and compensation of its victims

Etiology

Silicosis is due to inhalation of fine particles of silica (SiO_2) The hazard of inhalation of silica dust is governed by the following factors

- 1 The fineness of the particles Particles must be five microns or less in size to be dangerous
- 2 The concentration of the dust in the atmosphere and the per cent content of silica Air that contains more than 300 particles per c c of dust, and contains 6 per cent or more of pure silica is considered hazardous
- 3 Adulterating dusts inhaled with the silica It has been known for some time that various dusts inhaled with silica not only acted as diluents but also as directly inhibiting the development of the disease
- 4 A fourth factor is susceptibility of the workman It is known that manifest tuberculosis increases the susceptibility of the individual to silicosis Hence the importance of excluding workmen with known tuberculosis from exposure to silica dust There are other unknown factors, e g, other respiratory infections and unknown constitutional factors that increase

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susceptibility It is hoped that future research will clear our knowledge on these important points

Pathology

Silica dust, when inhaled into lungs, is not inert like most dusts, e g , coal dust When it comes in contact with the body juices, silica becomes definitely toxic by the liberation of an irritant biochemical product The phagocytes carrying the particles are definitely poisoned and most of them die in the lymph channels and small lymph nodes of the lung Other dusts including silicates, with the exception of asbestos, have not this action It is only silica, that can, as far as we know, produce the typical whorl shaped fibrosis which gives the specific nodulation seen in the x-ray films

Diagnosis

The diagnosis of silicosis is based on, *first*, occupational history There must be a history of exposure to hazardous silica dust for a substantial period of time We have seen a few cases in the British Columbia mines where the exposure was less than three years, all of them acute cases, but the large majority of our cases have been exposed for five years or more The shortness of exposure in some cases is explained by large concentrations of pure silica dust, but this is not the whole story There seems to be, in some workmen, a greater susceptibility to silica fibrosis than in others It has been found that even in rabbits some strains will become silicotic much more readily than others

The *second* standard of diagnosis is the typical nodular fibrosis seen in the x-ray film Without this typical nodulation one cannot make a diagnosis of silicosis It is true that the lungs may be "effectively occupied" by silica dust and the man be removed from contact with the dust for a period of years before the typical nodulation shows

Two soldiers who were miners prior to the war, both in the same mine, enlisted in 1941 Their enlistment films showed normal chests, yet in 1944 they both showed very marked silicosis, although during the period of three years they were in the Canadian Army Overseas they were not exposed to any dust The typical case may go on for a number of years and the annual x-ray examination show no change Gradually, however, there develops a generalized increase of the linear lung markings and some enlargement of the hilar shadows The linear markings gradually extend to the periphery, showing a fine reticulation There may be no change in this appearance for a number of years Irvine of South Africa has likened the appearance at this time to the branches of a leaf-

less tree—then rather suddenly, often in the space of six months or a year, the tree suddenly starts to leaf out—the leaves in this case being the discrete nodules, from 2 mm to 6 mm in diameter, widely spread over both lungs. At this time, there are usually few or no symptoms, except possibly, slight dyspnoea on heavy exertion. The disease may remain stationary at this stage for a number of years and the man can carry on at his work quite efficiently. Other cases may progress fairly rapidly, the discrete shadows becoming conglomerate, and showing evidence of silicosis with infection. The man becomes dyspnoeic, develops chronic cough with occasional blood spitting, and is only able to carry on at light work. If he develops manifest tuberculosis with a positive sputum, he rapidly becomes totally disabled and his life expectancy is reduced to a few years.

As to whether a given case will progress rapidly cannot be predicted, and as to why some do and others do not is one of our unsolved problems. Infection with tuberculosis certainly speeds up the progress of the disease, but a number of definitely acute cases of silicosis proceed rapidly to death without any evidence of tuberculosis.

In most cases the progress is slow. There is progressive increase of the fibrosis with compensatory emphysema, dyspnoea becomes quite severe on very little exertion. The man develops an irritative cough, some times with considerable wheeziness. His general health remains good but he cannot earn a living because of shortness of breath. Without serious intercurrent infections these men may live out their life expectancy, especially if they are economically provided for by some form of compensation.

Differential Diagnosis

It must be laid down as a dictum until further research proves the contrary that, unless a patient has the typical x-ray appearance of nodulation, silicosis cannot be diagnosed as a cause of disability. All the symptoms of silicosis may be present, with also sufficient history of hazardous exposure to dust. Emphysema, chronic heart disease with congestive failure, and asthmatic bronchitis all may produce similar clinical symptoms, and at times the x-ray appearance may be misleading. These cases are the ones that are often most difficult to decide in regard to compensation. There are a number of conditions which show a nodular x-ray appearance that are not due to silicosis.

Treatment

The reduction of the incidence of silicosis in hazardous industries is a matter of dust control. Proper ventilation, the use of

water, and above all adequate inspection of the mines by competent dust engineers, who not only can find the hazardous areas but have power to see that these hazards are corrected, are the first requisites to the control of silicosis. Aluminum dust used as a prophylaxis is likely to become useful and may be the additional factor that will make our future miners free from silicosis.

As far as the silicotic is concerned, there is nothing as yet that has proven of value. Aluminum dust has been shown to be effective in preventing silicosis in rabbits and also in arresting silicotic fibrosis when given in high doses. A short summary of the use of aluminum dust in prophylaxis and treatment may be of interest.

Use of Aluminum Dust in Prophylaxis and Treatment of Silicosis

In 1937, Denny, Robson and Irvine reported that in dusting experiments with quartz dust they could produce nodular fibrosis in rabbits, but if the quartz dust was mixed with a freshly ground aluminum powder in particles the size of less than 5 microns, with a proportion of aluminum dust of 1 per cent it would prevent the occurrence of nodular fibrosis.

In 1939, they showed this inhibiting action of aluminum is produced largely by covering the quartz particles with an insoluble and impermeable coating which is gelatinous hydrated aluminum, and which stains red with aurine. Further experiments, Belt and King showed the particles so treated were treated by the body cells as more or less inert bodies. Further work by several observers have shown that aluminum dust did not cause lung damage nor did it favour the development of tuberculosis or any other lung condition.

A few papers have come out of Germany describing harmful effects of aluminum powder. There have been some reports that hydrated aluminum has some effect in aggravating an existing tuberculosis. So far there has been no work done that is in any way convincing of this effect.

Following the publication of these beneficial effects of aluminum dust in rabbits, under the supervision of the McIntyre Research Ltd, prophylactic treatment has been installed in a large number of mines in Canada and other places. During the past two years most of the mines in British Columbia have installed this treatment. In the change room, or dry room, there has been installed a blower which blows from small canisters of aluminum powder, giving a concentration of 1 gram of aluminum dust per 1,000 cubic feet of room volume. This is inhaled by the men for a period of 10 minutes before going underground. The treatment is voluntary on the part of the men but has been enthusiastically adopted and

no bad effects have been noted. In fact, in some of the mines it has become quite popular as a cure for various respiratory complaints, and I have been told that some of the women are taking it for a variety of conditions. As to its effect in prevention of silicosis, there is no evidence as yet, nor is it likely that definite evidence can be provided for five to ten years. In no sense does the use of aluminum supplant the other important measures of dust control. In fact, more emphasis has been placed upon these measures.

In 1944, it was decided by the Workmen's Compensation Board of British Columbia to offer to certain pensioners from silicosis the opportunity of taking aluminum dust as a therapeutic measure for their disease. Under supervision of the McIntyre Research an air-tight chamber, 560 cubic feet capacity, was constructed. Into this chamber was blown aluminum dust from small canisters, to give a concentration of 0.5 mgms of aluminum powder per litre of air. The patients stood outside the chamber and inhaled through the mouth this aluminum dust for a period of ten minutes daily for one hundred treatments. The men selected were all definite cases of silicosis, who had developed no evidence of pulmonary tuberculosis. They were all pensioned from 50 to 100 per cent for disability due to silicosis. They were all assured that any improvement in their condition would not result in reduction of pension. They were all medically examined and x-rayed, both before and after treatment.

In giving results, the matter of improvement or no improvement is based on statement of the workman. In only two have there been changes for the better in the x-ray films. In the rest, there has

RESULTS OF ALUMINUM DUST THERAPY IN SILICOTIC PENSIONERS

Total starting treatment	36
Total completing 100 treatments	15
Total completing less than 100 but 50 or more	8
Total completing less than 50 treatments	9
Total still under treatment or not reported	4
Results in 23 who took 50 treatments or more	
Improved	13
Unimproved	6
Worse	4
Of these 23 — 10 were on 100 per cent pension	
10 were on 60 per cent pension	
3 were on 50 per cent pension	

been no change There has not been any evidence of progression While some of the patients stated they were worse, we have noted no harmful results It has been found that at the beginning some of the workmen had increase of cough for a few days but this did not persist The psychological effect has been good and the morale greatly improved

It is impossible to come to any conclusions from such limited numbers The statement of improvement was entirely symptomatic, and similar results might be obtained by giving any harmless treatment with a large dose of hope and faith However, generally speaking, the psychologic effect was good on at least fifty per cent We did not think there was any harm done even in those who stated they were unimproved or worse

As regards the future use of aluminum dust, we are of the opinion that it does no harm As a prophylactic its position has been well established by animal experiment It will be some years before we can assess its full value in humans As a therapeutic measure its use at present is entirely experimental, and a great deal of animal experimentation remains to be done before it can be accepted generally as of any more than psychological value in the treatment of silicosis Aluminum cannot in any way supplant as a prophylactic the most important measures of dust control

The Silicosis Problem In B C

In normal times there are from 4,000 to 5,000 men employed underground in the hard rock mines of British Columbia Up to 1936 it was not a compensatable disease and as far as prevention of silicosis was concerned there was no adequate inspection of the dust and ventilating conditions in the mines There had been a law preventing dry drilling and also some regulations as kept down dust by water, but generally speaking conditions were very hazardous

In 1935, a survey was made of five of the leading metalliferous mines (Table I)—to obtain a cross section of the prevalence of silicosis

All the sillicotics were miners who had worked five years or more

TABLE I

Total Number Examined	1,339	
Negative Findings	1,224	Per cent 91.41
Simple Pulmonary Tuberculosis (All but one of these had worked less than five years underground)	10	0.75
Silicosis	105	7.84
	1,339	100.00

underground Total number of miners examined who had worked five years or more underground, 703 Of that number 105, or 14.9 per cent, were silicotics

Tuberculosis was a probable complication in 3 of the stage 3 cases of silicosis (Table II)

TABLE II

Summary of 1,339 Men Examined

Years underground in Metal Mines	Negative	Simple Pul Tbc	1	Stage of Silicosis 2	3
1 yr or less	273	4			
1 to 5 yrs	354	5			
5 to 10 yrs	327	1	16	3	
10 to 15 yrs	207		27	9	2
15 to 20 yrs	31		7	5	3
20 to 25 yrs	20		8	11	
25 to 30 yrs	10		7	2	2
30 to 35 yrs	2		1	1	1
	1,224	10	66	31	8

SUMMARY

Out of 703 miners who had been five years or more underground, 105 or 14.9 per cent were silicotics, 62.8 per cent of these were Stage 1, 37.2 per cent were showing disability

Following this survey, silicosis was made a compensatable disease and it was made compulsory for mine owners to have their employees going underground given a yearly examination with x-ray film of the chest. At the present time any workman who has been exposed to silica dust in the mines of British Columbia for a period of three years, or for a lesser period if not exposed outside of British Columbia, is eligible for compensation for disablement due to silicosis

Silicosis as defined under the Act "shall mean a fibrotic condition of the lungs caused by dust containing Silica and evidenced by specific x-ray appearance, accompanied by a substantially lessened capacity for work."

The regulations regarding annual examination of employees are that each employee must have a medical examination and x-ray film of his chest and a certificate for fitness for underground work issued within two months of the time he starts working underground and this examination must be repeated annually

These examinations are made by the mine doctors at the expense

of the employer The examination forms and x-ray films are forwarded to the Workmen's Compensation Board and reviewed there by the Silicosis Referee who may cancel or re-issue any certificate if he considers it advisable

The policy in regard to issuing certificates is that all cases of suspected active tuberculosis shall be excluded

Cases of silicosis showing progression or complicated by tuberculosis are advised to apply for compensation and removed from underground work

Cases of early silicosis which are not showing progression, especially in the older men, are issued certificates if they wish to continue We have not found that these cases progress substantially faster when removed from underground work than if allowed to remain at work to which they are accustomed Compensation is based on disability and it is an economic disaster to remove men from work they have been doing for fifteen or twenty years and ask them to make a living at something else We consider also that most of the mines of British Columbia are now reasonably safe

Besides compensation and yearly examinations, in September 1937, the Workmen's Compensation Board appointed a competent dust inspector to visit the mines at regular intervals, and to make dust counts and recommendations regarding improvement of ventilation A second man has recently been appointed Under their recommendation many hundred thousands of dollars have been spent on improving the dust conditions They report that in most mines conditions are reasonably good Their standard is 300 particles of dust or less per cc of air In some parts of the mine, as in the raises where the men are drilling, conditions are still hazardous, counts being sometimes as high as 2,000 particles per cc, so that it is not possible as yet to do away entirely with hazardous dust

It is our impression, not as yet confirmed by accurate statistics, that there is a definite fall in recent years in the incidence of new cases of silicosis It must be remembered that at the time this disease was made compensable, there were a large number of miners who had advanced silicosis, either working or who had just stopped working There were also a large number of men who had already been exposed for four or five years to old conditions prevailing before 1937 It is therefore going to be some years yet before we can estimate the benefit being derived from general dust prevention measures, as well as the use of aluminum

RESUMEN

De 703 mineros que habían trabajado subterráneamente cinco años o más, 105, o sea el 14.9 por ciento, eran silicóticos, el 62.8

por ciento de estos se encontraban en el Período 1, mientras que el 37.2 por ciento sufrían incapacidad

Subsiguiente a este censo se declaró que la silicosis sería una enfermedad indemnizable y se obligó a los dueños de las minas a que sometieran a exámenes anuales con películas radiográficas del tórax a todos sus empleados que trabajaban subterráneamente. Al presente, todo trabajador que ha estado expuesto al polvo silícico en las minas de la Columbia Británica por un período de tres años, o por un período más corto si no se ha expuesto fuera de la Columbia Británica, es elegible a obtener indemnización por incapacidad debida a silicosis

De acuerdo con la definición de la Ley, por silicosis "se da a entender una condición fibrosa del pulmón causada por polvo que contiene Sílice, y evidenciada por el aspecto radiográfico específico, acompañada de una disminución substancial de la capacidad para el trabajo"

Los reglamentos relativos al examen anual de los empleados exigen que todo empleado debe ser sometido a un examen médico y a una película radiográfica del tórax, y que debe obtener un certificado de aptitud para el trabajo subterráneo expedido dentro de dos meses, a partir de cuando comience a trabajar subterráneamente, y que se debe repetir anualmente este examen

Los doctores de la mina hacen estos exámenes a costa del patrono. Los resultados de los exámenes y las películas radiográficas son remitidas a la Junta de Indemnización de Trabajadores donde son revisadas por el Arbitro de Silicosis, quien puede cancelar o re-expedir cualquier certificado si lo considera prudente

El plan de acción en cuanto a la expedición de certificados, es que se debe excluir a todos los casos sospechosos de tuberculosis activa

A los casos de silicosis que manifiestan progresión o que están complicados por tuberculosis se les recomienda que soliciten indemnización y se les retira del trabajo subterráneo

A los casos de silicosis precoz que no manifiestan progresión, especialmente en los hombres más viejos, se les expiden certificados si desean continuar trabajando. Hemos notado que estos casos no progresan con menor rapidez cuando se les saca del trabajo subterráneo que cuando se les permite que continúen en ese trabajo a que están acostumbrados. La indemnización está basada en la incapacidad y es un desastre económico el sacar a estos hombres del trabajo que han estado haciendo por quince o veinte años y obligarlos a ganarse la vida en otra forma. Consideramos además que dele la mayor parte de las minas de la Columbia Británica están ahora a salvo

Además de las indemnizaciones y de los exámenes anuales, la Junta de Indemnización de Trabajadores nombró a un competente inspector de polvo, en Septiembre de 1937, para que visitara las minas a intervalos regulares, y para que hiciera estudios del polvo y ofreciera recomendaciones con el objeto de mejorar la ventilación Recientemente se ha nombrado a otra persona más Si-guiendo sus recomendaciones se han gastado muchos cientos de miles de dólares para mejorar las condiciones de polvo Informan ellos que en la mayor parte de las minas las condiciones son razonablemente buenas Su norma es de 300 partículas de polvo, o menos, por cc de aire En algunos lugares de la mina, como en los levantamientos donde los hombres están taladrando, las condiciones todavía son peligrosas, pues las cuentas a veces ascienden a 2000 partículas por cc, así es que todavía no es posible eliminar por completo el peligro del polvo

Nuestro parecer, no confirmado todavía por datos estadísticos exactos, es que en los años recientes ha tenido lugar una disminución bien definida en la frecuencia de nuevos casos de silicosis Debe recordarse que cuando se declaró que esta enfermedad sería indemnizable, existía un gran numero de mineros que padecían silicosis avanzada que todavía estaban trabajando o que acababan de dejar de trabajar Existía también un gran numero de hombres que ya habían estado expuestos por cuatro o cinco años a las anticuadas condiciones que prevalecían antes de 1937 De manera pues que no será sino dentro de varios años cuando podremos calcular el beneficio derivado de las medidas generales para eliminar el polvo, así como del empleo del aluminio

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Pneumococcus Pneumonia and Its Complications*

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The subject of this essay is pneumococcus pneumonia and its complications as seen in San Francisco over various periods of study from December 1932 to June 1946

Pneumonia has been ever present in San Francisco though it has been of varying severity and etiology from year to year. Until the 1918 epidemic of influenza and the pneumonias which complicated it, pneumococcus pneumonia is said to have been much more common than in the years which followed the first world war. It is also said that the respiratory flora in the years following the first war was such that most of our serious respiratory infections were due to organisms other than the pneumococcus and many of them were largely concerned with the streptococcus. It was also believed that lobar pneumonia of pneumococcus origin was considerably less prevalent in California than in the Eastern United States and in the midwestern states. Since 1931, there has been a return to the usual varieties of pneumonia and it is apparent now the severity of the disease is essentially the same here as in other parts of the United States though the disease is still probably not as frequently encountered as on the eastern seaboard. Marked variations of morbidity and mortality may occur from year to year, as shown by the paucity of pneumonia in San Francisco during the most recent eleven month's period.

The purpose of this paper is to discuss pneumonia in this area over three widely separated periods starting in 1932. The first study was made at the San Francisco Hospital from December 1932 to June 1933. The tabulation of figures of this period with the figures of the complications, results of treatment, etc., will be followed by the description of a second period in which specific therapeutic agents were used, and which show improvement in the mortality rate, and the last period which shows results of more efficient therapeutic combinations.

In the early figures for 1932 and 1933 the general consideration is about as follows. The average age of this first group was 42 years. The eldest 77 the youngest 5. Males and females were affected in the ratio of 3 to 1. When one remembers this is a city hospital group one must know that complicating disease was high

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and the commonest chronic ailment was circulatory disease as manifested by hypertension and congestive failure, coronary artery disease, and abnormal cardiac rhythms. Complicating factors were such things as syphilis, tuberculosis, malignancy, alcoholism, etc. With all of these factors taken into consideration, the mortality for the 1932-33 period was approximately 42 per cent. With those individuals who were unfortunate enough to have a positive blood culture on entry, the total mortality was 60 per cent, while of those who had negative blood cultures 19 per cent died.

For the period December 1932 to June 1933, during which time 250 individuals with pneumonia were seen, empyema occurred 7 times with 4 dead and 3 recovered. Pericarditis occurred 5 times, 3 died and 2 recovered. Two of these who died with pericarditis, also had empyema. Pleural effusion without empyema occurred on 31 occasions. On 2 of these occasions, streptococcus was found in the pleural fluid and in the remainder the pleural fluid was sterile. Of these individuals, 9 or approximately 29 per cent died and 22 or 71 per cent survived. Known endocarditis occurred in only 1 of this group of 250 and that individual died, while meningitis occurred 4 times with 4 dead, in each instance due to pneumococcus type IV. Lung abscess occurred 4 times, 2 of these individuals died and 2 recovered. One of these with lung abscess who died also had empyema. Thus it will be seen that there were 52 complications in 49 patients,—that is approximately 20 per cent of the patients in this early series showed complications of a serious nature.

The treatment of this first group was confined to nursing, oxygen, increased fluid intake, the use of alcohol in those chronically addicted to its use, and in a small number specific antiserum was used, and in those individuals who had serious abdominal distention, an increased amount of sodium chloride was used to combat this complication.

The second group of cases comprises 250 patients with pneumococcus pneumonia seen in the same hospital in the 2 years from July 1943 to July 1945. The age range and complicating disease was approximately the same as in the earlier group. It is interesting that in this group those with negative blood cultures had a mortality rate of approximately 11 per cent, while those with positive blood cultures had a mortality rate of 42 per cent. Total mortality rate for the two years was approximately 16 per cent, the total rate being 26 per cent in 1943-44 and 13 per cent in 1944-45.

The treatment of this group in addition to the routine noted above, consisted in sulfadiazine which was used in 70 per cent of the individuals treated and sulfamerazine in 18 per cent, and a few patients only were treated with sulfathiazole. All of these sulfa

drugs were used in the routine fashion with an initial dose of 4 grams followed by 1 gram every four hours of sulfadiazine and 1 gram every 8 hours in the case of sulfamerazine. Those patients who appeared to be in serious condition were given the sodium salt of the sulfa drug in initial dose of 5 grams in 1,000 cc of lactated Ringer's solution. In addition to this, due to high mortality rate of type VII those individuals with positive blood cultures of type VII were likewise given rabbit serum in doses of about 200-300,000 units.

This group showed 41 complications as previously listed or a really higher rate of complications than in the group of 1932-33, empyema heading the list with 13 cases with 3 deaths or an empyema mortality of 23 per cent compared to the higher mortality of 57 per cent in 1932-33. Let it be pointed out here that the number of cases involved is far too small from which to draw accurate conclusions. All those individuals with endocarditis and lung abscess died. These, of course, remain the most serious complications of pneumococcus infection. In the second period, 1943-45, 16 deaths were attributable to what we choose to call "peripheral vascular collapse." This cause of death was not listed in our earlier figures, due to failure of classifying deaths in this category. In the 1943-45 period 18 individuals were seen who, we felt, were in this category, and all but 2 died, or 89 per cent.

When this study was undertaken, it was thought that for the period July 1945 to June 1946 we would have commensurate figures to present, but the year failed to produce a great number of pneumonias so that for this last period, 1945-46 we have only 45 pneumococcus pneumonias to report. In addition to there being but few cases on our service this year, the pneumococcus pneumonias were also quite mild, there being only 4 deaths among the 45 patients or a mortality of about 9.5 per cent. As further evidence of the mildness of the infections, only 18 had positive blood cultures or a positive blood culture rate of 40 per cent, but 3 of the 4 deaths recorded were among those with positive blood cultures, the positive blood culture mortality thus being 16 per cent, or the lowest positive blood culture mortality rate which we have recorded. Let it be again noted that the numbers are too small for accurate statistical data. Of those individuals who failed to show a positive blood culture only one died and that one was moribund on arrival on the ward.

The complications including so-called peripheral vascular collapse numbered only 12 or about 28 per cent, but queerly enough among the patients with complications only one person died, and he was the single one who had peripheral vascular collapse. None of the 5 persons with empyema, the 5 with pleural effusion, or the

1 person with lung abscess died In this last eleven months there was no case of either meningitis or endocarditis One individual who had a positive blood culture with type VIII pneumococcus, and who also had an empyema was treated with sulfadiazine, penicillin, and rabbit antiserum, and survived

It seems almost without purpose to break down further the figures of the last eleven months, since the cases are too few for accurate statistics, yet it may be mentioned that of the 18 persons treated with sulfadiazine or sulfamerazine alone, none died Obviously they responded well to this drug, or in these days they would have had further help from both penicillin and/or serum We believe it should also be mentioned that those persons seriously ill *were* treated with sulfonamides and/or penicillin Twelve persons were treated with penicillin alone and two died, both of whom were moribund on entry to the ward, one being unconscious on entry, living only 7½ hours and the other, aged 63 with a leucocyte count of 4,600 per c m m lived less than 48 hours Fifteen persons seriously ill were treated with both penicillin and sulfadiazine, 2 of whom died, both having positive blood cultures and one having had several ribs broken before entry, and both of whom were seriously alcoholic and developing delirium tremens in the hospital The person with the broken ribs survived eleven days Any recital of statistics on pneumonia is useless unless some conclusions may be drawn, as to the cause of the variation in the figures presented

All of the patients presented in these three groups, as well as all of those seen in the interim years not reported had certain basic therapeutic procedures used upon them These consisted of bed rest, nursing care, fluids orally or parenterally, liquid or soft diet, alcohol when indicated, sedatives and drugs for relief of pleural pain, surgical relief for collections of fluid in the chest, salt restoration and whatever drugs were indicated for the cardiac conditions arising during the disease or present on entry

In the early years the use of specific serum was a factor in the treatment, but not a great one with us even though the mortality rate was somewhat lowered by its use

In the years after 1938 sulfonamides were used almost universally, with definite reduction in the mortality rate, but not until 1942 were they used in all cases, so that the 1943-45 period was a good one in which to estimate the mortality rate with this therapy, and of course, this was with a great reduction from the earlier years It is our impression, that the use of these drugs alone is responsible for the saving of many lives in this disease and even though the *rate of complication is not lowered by the use of these drugs* the mortality from complications is lowered

It is also our impression that if sufficient dosage of these drugs can be maintained over a sufficient length of time, certain of the complications such as pneumococcus meningitis which were almost hopeless before the advent of the sulfonamides may be favorably influenced, while the combination of sulfa drugs and penicillin together, wisely used, may also *prevent* some of the serious complications or at least make them less serious

Our present ability to go directly to the seat of trouble in empyema or meningitis with such a potent drug as penicillin was the dream of our forbears, and only since the advent of penicillin is this possible. Three of the empyemas seen in 1945-46 (total seen, 5 in number) were treated by the closed method, i.e., by tapping one or more times and instilling penicillin directly into the chest cavity in doses of from 50,000 to 100,000 units, and in each instance cessation of the empyematous condition resulted. Recurrent drainage by needle or trocar was all that was necessary in 2 other cases.

Pleural effusion, which may or may not have resulted in empyema under earlier conditions, so called rather than empyema because of failure of growth of organisms from the chest fluid, was present 5 times and treated with instillation of penicillin 3 times, with cure on two occasions without further treatment, and with further drainage in one instance. On two other occasions, small amounts of pleural fluid were evacuated without the necessity of further tapping, as the fluid was sterile on culture and did not recur.

SUMMARY

1) Statistics on a relatively small number of cases of pneumococcus pneumonia in San Francisco have been presented. While our statistical data are small, it is in accord with the figures presented in larger series.

2) There has been a constant reduction in mortality rate consistent with the introduction of newer therapeutic agents.

3) Complications may be less and certainly the consequences of complications are less severe with the employment of the newer drugs.

4) The high mortality rate formerly accompanying the positive blood culture have been drastically reduced by the use of these newer drugs.

5) We must not overlook the fact that marked variations in the severity of infection and variation in morbidity influence the statistics in pneumococcus pneumonia to a large extent.

We acknowledge with thanks the aid of the resident staff and visiting staff of the University of California Medical Service at the San Francisco

Hospital, particularly Doctors George Warner and Frank Gardner for their aid in the preparation of the statistics presented

We likewise acknowledge the cooperation of the Director of Public Health of San Francisco, without which this study would not have been possible

RESUMEN

1) Se han presentado datos estadísticos sobre un numero relativamente pequeño de casos de neumonía neumocócica en San Francisco. Nuestros datos estadísticos, aunque son pocos, están de acuerdo con las cifras presentadas en series más amplias

2) Ha tenido lugar una reducción constante en la mortalidad, consistente con la introducción de agentes terapéuticos más modernos

3) Puede haber menos complicaciones e, indudablemente, las consecuencias de estas complicaciones son menos graves cuando se emplean las drogas más modernas

4) La alta mortalidad que antes acompañaba a los casos en los que el cultivo de la sangre era positivo ha sido reducida en extremo con el uso de estas nuevas drogas

5) No debemos pasar por alto el hecho de que marcadas variaciones en la gravedad de la infección y variación en la morbilidad influyen en sumo grado los datos estadísticos referentes a la neumonía neumocócica

Lung Abscess (Surgical Aspects)*

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I wish to make this presentation as succinct and practical as possible. It will, therefore, be necessary to pass over many aspects of the general hygienic care, adequate diet, vitamin administration, bacteriological findings and etiology, which are of importance in a general discussion of pulmonary abscess. Suffice it to say, it is the belief of most of us that pulmonary abscess, in general, is a disease of aspiration rather than an embolic disease.

I have long been opposed to the tendency of many physicians to separate the management of lung abscess into medical treatment for one period of time and surgical treatment for another. In the not too far distant past it was the custom to set a time limit, usually from six weeks to three months for the period of purely "medical treatment." If the abscess was not cured by then, the case automatically became surgical. The effects of treating such a serious disease by any similar routine have been amply reflected in the appalling mortality statistics of past years. While it has been estimated that from 25 to 35 per cent of patients with pulmonary abscess become well spontaneously, the mortality has been from 30 to 50 per cent in most series of prior years. The communications of Neuhof, Overholt and Rummell, Betts and others have demonstrated that such a mortality can be reduced. If the abscess is to be treated definitively, it should be done during the acute phase. Within six weeks from the onset chronic changes, pathologically, already have become established in the pulmonary parenchyma and the optimum time for a cure is past.

There is now, I believe, greater appreciation of the fact that pulmonary abscess is a very unpredictable disease with ever-present surgical potentialities and that the best results are obtained by the physician and thoracic surgeon working as a close team from the onset.

Pulmonary abscess has the characteristics of abscess elsewhere in the body in that cure is dependent upon adequate drainage. Because of the bronchial connection in all pulmonary abscesses it is possible that so-called internal drainage may suffice. I would,

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therefore, rather speak in broad terms of the drainage aspects of pulmonary abscess rather than of the purely surgical aspects since an appreciable percentage of abscesses may be cured by improving internal drainage

As a general working rule and without specifying too closely concerning bacteriology, the odor of the excretions from a pulmonary abscess gives some index as to how early or how necessary external drainage, i e , surgery, may be. A more putrid odor usually means a higher percentage of anaerobic organisms. In such abscesses it is usually more certain that early external drainage will be necessary.

The use of chemotherapy or antibiotic therapy must not be minimized in the treatment of abscesses. It has been suggested, moreover, that the combination of a sulfa preparation and penicillin may be more efficacious than either drug used alone. Such treatment can be overdone, however, and it must always be remembered that adequate drainage is necessary regardless of how many grams of sulfadiazine or how many thousand units of penicillin are poured into the patient. It is possible that the abscess cavity even may be temporarily sterilized although a slough remains. This still necessitates external drainage, regardless of the fact that organisms are absent for the time being.

Once the patient with pulmonary abscess has come under the physician's care, improvement must be prompt and progressive or the course of treatment should be radically changed. This improvement must be both clinical and roentgenological. No abscess is doing well which remains unchanged on the roentgenogram for two or three weeks at a time even if there has been an amelioration of symptoms.

As has been stated above, the essential treatment of pulmonary abscess is to improve drainage. Internal drainage is promoted by postural drainage and by bronchoscopic aspiration. Postural drainage, unless it is done carefully, may produce more harm than good. Many of these patients are acutely ill and cannot stand the physical exertion of routine postural drainage. The type of postural drainage which should be used must be individualized. In general, the patient should be instructed to assume the position which makes him cough most, four or five times during the day. Cough is a natural defense mechanism on the part of the body in raising secretions and is a good index as to whether or not postural drainage is being done in the most efficient position. The usual position of postural drainage with the patient hanging over the bed almost straight down from the hips may be harmful if the abscess is in the middle or upper lobes.

It is obvious to those of us with experience that the bronchoscope

is an invaluable means of improving internal drainage in many cases of pulmonary abscess. In the past bronchoscopy has been used far too infrequently during the acute stage. Bronchoscopy should be one of the earliest therapeutic procedures employed. It has been stated that many of these patients are too sick to be subjected to bronchoscopy. Rather it should be said that they are too ill not to be bronchoscoped. There are many who are still unconvinced as to the value of bronchoscopy in pulmonary abscess. I am certain that such physicians either have not had the benefit of an efficiently performed bronchoscopy, or, they have been swayed by the bronchoscopist's enthusiasm and allowed repeated bronchoscopies (as many as fifteen to twenty) to be performed without appreciable improvement in the patient's condition. This cannot be construed as an indictment against the method but only an indictment of the bronchoscopist's judgment. The bronchoscope is not an infallible instrument. One must not try to do the impossible with repeated aspirations if progressive clinical and roentgenological improvement does not ensue.

In brief, the bronchoscopist can be depended upon to do the following tasks: (1) Remove obstructing inspissated excretions from the main and secondary bronchi, (2) Make an occasional diagnosis of unsuspected foreign body or neoplasm as the causative agent of the abscess, (3) Elicit selective cough with further evacuation of excretions from the affected lobe, (4) Shrink the congested edematous mucosa which in itself can cause visible obstruction of the bronchial airway, (5) Pass long curved aspirators well into the smaller bronchi of the diseased pulmonary segment and, rarely, directly into the abscess cavity.

In favorable cases, such as illustrated below, the effects of bronchoscopy can be seen within a few days after the first aspiration. When such improvement occurs it is unquestioned both clinically and roentgenologically. When doubt exists as to whether improvement is taking place, a second or even a third bronchoscopy at five to seven day intervals may be indicated. If there is still a question after seven to fourteen days it is then unlikely that any improvement has occurred and the course of treatment should again be changed. Undoubted clinical improvement is manifested by decrease in the cough, reduction in the amount of sputum, a change in the character and odor of the sputum, a reduction in the fever, and an increased sense of well being on the part of the patient. Should the fever continue at its previous level, or should the secretions remain purulent and foul it is certain the bronchoscopy is not being effective.

In general brisk hemorrhage contra-indicates bronchoscopy and should be an indication for early surgical drainage. Sudden thor-

acic pain, dyspnea and evidence of rupture of the pulmonary abscess into the pleural cavity are likewise contra-indications for further bronchoscopy

Rupture of an abscess into the pleural cavity constitutes a surgical emergency. The overwhelming toxicity which develops from the insult of a virgin pleura with necrotic debris and anaerobic infection frequently leads to rapid termination. When faced with such a situation, temporizing with repeated aspirations and the injection of sulfa drugs or antibiotics is almost certain to end disastrously. Likewise closed intercostal drainage of this type of acute empyema is unsatisfactory in the extreme. Such treatment frequently results in a spreading anaerobic cellulitis and fasciitis of the thoracic wall and the mortality is very high. The treatment of choice is to ignore the abscess for the time being and to open the pleural cavity widely by posterior resection of a long length of the eighth or ninth rib. Rapid evacuation of infected contents is accomplished and multiple Penrose drains are introduced into the pleural cavity, supported by a large pack. If, and when, the lung re-expands the abscess can be dealt with as necessary at a later date.

If, within two or three weeks of the onset of the abscess (or at the most six weeks), there has not been evidence of steady improvement external surgical drainage should be undertaken. If performed within this period of time it is probable that changes in the parenchyma due to chronic infection, such as increased scar tissue formation, and bronchial damage with associated bronchiectasis have not yet occurred. In most instances a decision can and should be made long before the expiration of six weeks.

It is generally agreed that most abscesses can be drained by a one-stage technique and this is certainly preferable if it can be accomplished. Since nearly all abscesses present on a pleural surface, adhesions rapidly form between the thoracic wall and the lung. Accurate roentgen localization is necessary prior to operation. Following the removal of sections of one or two ribs it can be easily seen whether or not adhesions exist beneath. Should there be no adhesions some type of irritating pack such as half-strength tincture of iodine or 1-1000 acriflavine solution should be used for a period of approximately seven days between stages. Generally it is wise to recheck with roentgenograms between stages to be sure that one is approaching the abscess properly. The abscess should be opened with a cautery and the contents evacuated simultaneously with suction. The cavity is then packed loosely with gauze and repacked as necessary until healing takes place. In most instances where the abscess is acute and the destruction of lung has not been too great, healing by resolution and by re-

expansion of the remaining lung will take place, with gradual obliteration of the abscess cavity. In some instances the healing process may be delayed beyond six weeks. If the cavity is clean, some type of filling with free fat grafts or with a pedicled muscle flap is advisable.

Treatment of chronic pulmonary abscess presents a considerably



FIGURE 1

FIGURE 2

Fig 1, Case 1 Frontal roentgenograms showing multilocular abscess in left upper lobe. This film was taken five days before the first bronchoscopy. No essential change in roentgenogram over a period of three months—*Fig 2 Case 1* Roentgenogram taken five days following first bronchoscopy (10 days following Fig 1). Marked regression of the abscess has occurred. Note the loss of fluid levels and decreased infiltration. The clinical improvement was rapid.

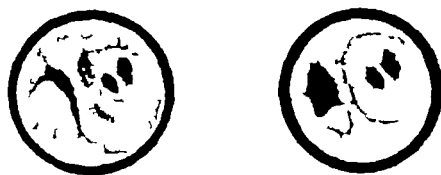


Figure 3 Case 1 (A) Bronchoscopic view of left upper lobar orifice. The partial obstruction is due to tenacious purulent sputum and mucosal edema. (B) Six days later. The mucosal edema and congestion have subsided. A single globule of pus remains. (This figure reprinted from Samson P. C. *Am Rev Tuberc* 38:638 December 1938)

different problem External drainage of such abscesses is often unsuccessful because of secondary changes in the lung If they have been drained, the cavity often will not become obliterated, fistulae will remain open and purulent discharge will persist Prior to operative intervention a complete study of the lung should be done by bronchoscopic examination and bronchograms If the bronchi show any deviation from the normal or if there is bronchiectasis, lobectomy is by all odds the treatment of choice Lobectomy performed in the modern manner, carries far less hazard than the external drainage of a chronic abscess

The following case briefs illustrate some of the points which I have emphasized The first two cases show the value of bronchoscopy in improving internal drainage In both cases there is little doubt that bronchoscopy was the deciding factor in returning these patients to health It will be noted that one case was treated before

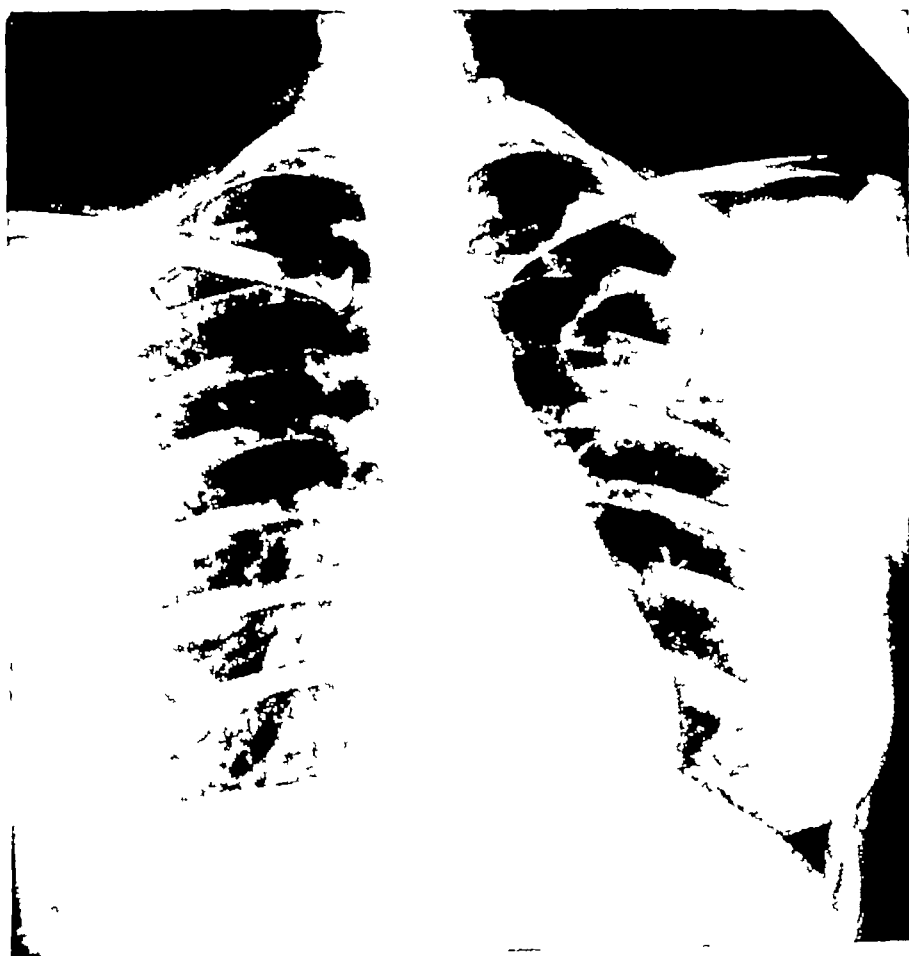


Figure 4, Case 2 Frontal roentgen film taken two days prior to bronchoscopy There is a 5 cm cavity in the anterior portion of the left upper lobe which shows a fluid level and considerable surrounding pneumonitis

the advent of chemotherapy and the second had both sulfadiazine and penicillin in addition to the other treatment

Case 1 This seventy one year old male had an acute onset three months before I saw him, characterized by a left-sided pleurisy, fever of $102 - 103^{\circ}$ and a racking cough. Within a short time he was raising 200 to 300 cc of foul sputum daily. During the three months period he was kept on strict bed rest with a modified postural drainage. There was slight clinical improvement, the fever only peaked at a 101° and he was raising 150 to 200 cc of foul sputum a day. The roentgenogram, however, had remained essentially unchanged during the three months (Fig 1). Of course in a man of this age an excavating carcinoma had to be considered. Bronchoscopy was done at once and was repeated six days later. The second roentgenogram was taken five days following the first bronchoscopy (Fig 2). Four days following the first bronchoscopy the sputum had become odorless and temperature was normal. Four days following the second bronchoscopy all cough and expectoration ceased. Figure 3 shows the bronchoscopic appearance at the time of the two bronchoscopies. It will be noted that in (A) there is partial obstruction of the left upper lobar bronchus from edema and tenacious purulent secretions. This had decreased markedly within six days.

Case 2 This thirty year old female delivered her third child following a difficult and prolonged labor. Gas and oxygen had been given and the patient responded poorly. She was cyanotic and the pulse was irregular. Within two days there was soreness of the left upper anterior chest and the patient developed cough, sputum and fever. The sputum had no

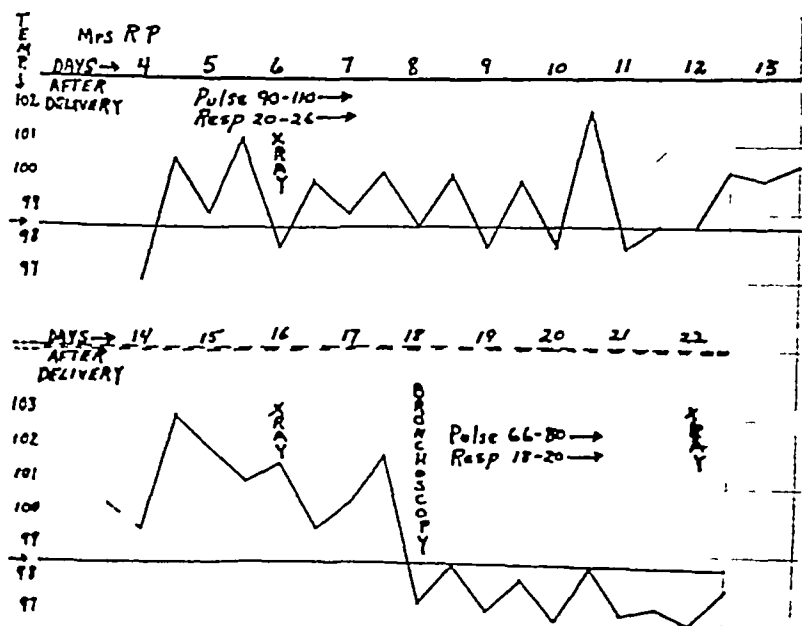


Figure 5 Case 2 Graphic record of temperature. Note immediate subsidence of fever following bronchoscopy.

odor but had a bad taste She was placed on both sulfadiazine and penicillin therapy Roentgenograms showed a rounded excavation in the left upper anterior chest (Fig 4) She was running a swinging fever Following bronchoscopy there was an immediately subsidence of temperature to normal and within four or five days all sputum ceased (Fig 5) There was rapid clearing of the abscess in serial roentgenograms (Fig 6)

As has been emphasized above the patients who do not improve progressively on a regimen consisting of postural drainage, bronchoscopy and chemotherapy should be subjected to surgical drainage within a relatively short period of time, usually in from two to three weeks This means that surgical drainage will be performed ideally during the acute or subacute stage It must be constantly kept in mind that merely "holding one's own" is not sufficient



FIGURE 6

FIGURE 7

Fig 6, Case 2 Film taken four days following bronchoscopy Radiologic improvement manifested by a decrease in the size of the abscess, disappearance of fluid level and lessened surrounding reaction

Fig 7, Case 3 Roentgen film taken December 11, 1945 Note the area of infiltration in which is a small radiolucent zone This suggests an abscess cavity partially filled with necrotic debris Fluoroscopy three days prior to the bronchoscopy on December 26th showed essentially the same picture

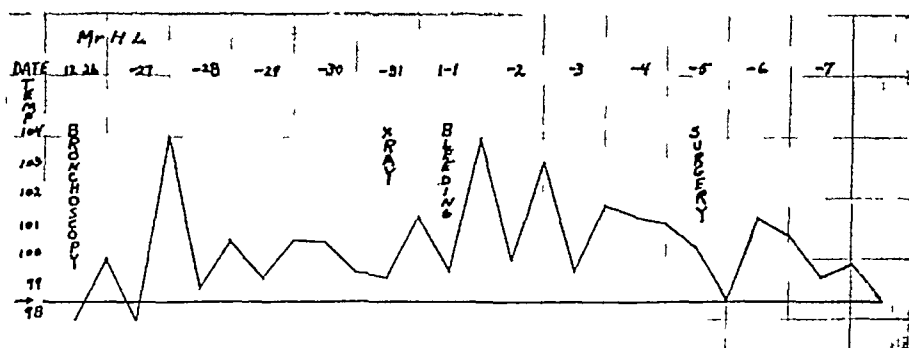


Figure 8, Case 3 Temperature graph following bronchoscopy It will be seen that the fever continues The patient's cough and expectoration were unabated

Insofar as pulmonary abscess is concerned a stationary course is a retrogressive course Both clinical and roentgen improvement must be obvious A single case record will suffice to demonstrate the desirability of proceeding with surgery when other methods have failed

Case 3 This thirty five year old male had a febrile pulmonary illness in August 1945 but apparently recovered from this Late in November 1945 he developed productive cough with foul sputum and blood spitting There was loss of weight He was hospitalized during early December and placed on postural drainages and large doses of penicillin (Fig 7) There was little improvement and his fever continued Bronchoscopy on December 26, was followed by increased fever and by an increase in the amount of expectorated blood (Fig 8) Roentgenograms showed pro-

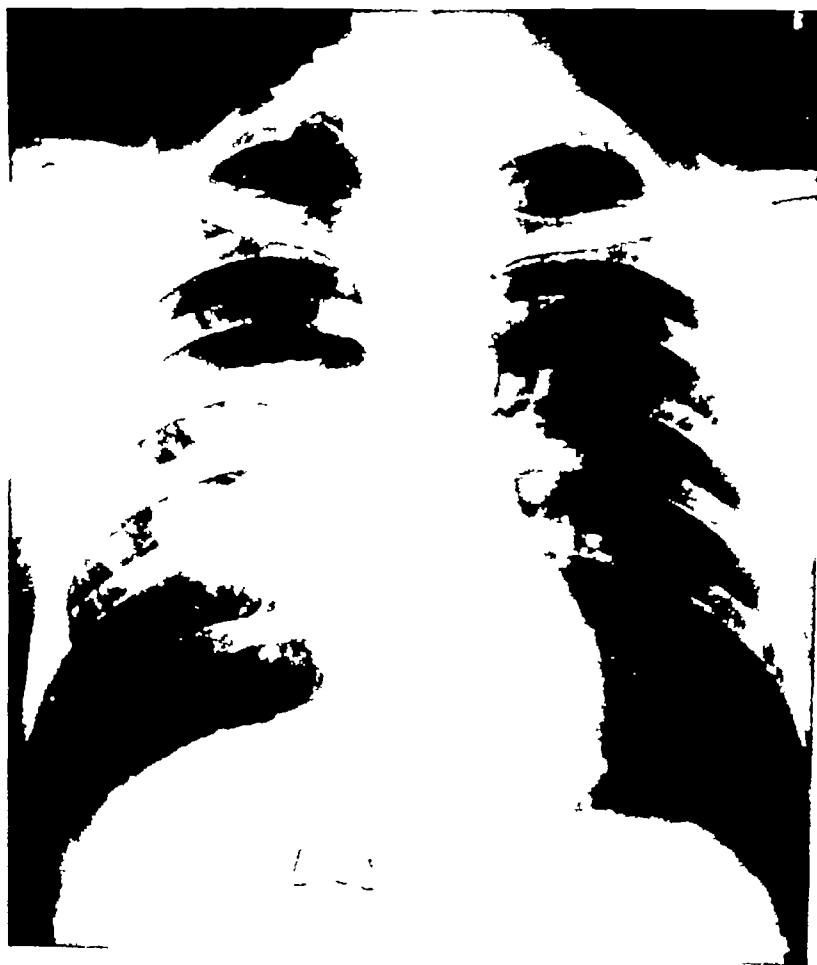


Figure 9 Case 3 This film was made five days following bronchoscopy There is progression of the infection

gression of the infection and surgery was instituted within a few days (Fig 9) After a prolonged convalescence the patient's lung eventually became expanded, the bronchial fistulae sealed over, and the sinus became epithelialized

In general, the more chronic the abscess the less chance does it have of being cured by external drainage It is becoming more widely recognized that chronicity brings in its wake secondary changes in the involved lung which may make cure by drainage an impossibility Occasionally one may be tempted to perform secondary drainage procedures on an abscess which is not "cleaning up" properly These procedures are frequently unsuccessful because of the underlying irreversible pulmonary damage In fact, Churchill has stated that no abscess which must be redrained will be cured Further drainage may be indicated, however, if a secondary acute abscess develops as an extension of the original process

Many surgeons are convinced that chronic pulmonary abscess should now be treated primarily by pulmonary resection rather than by external drainage If preoperative survey shows an entire lobe is damaged total lobectomy should be performed If the disease is *definitely* localized, segmental lobectomy may be indicated The lingular division of the left upper lobe and the dorsal (or apical) divisions of the lower lobes lend themselves particularly well to segmental lobectomy If all lobes on one side are involved, total resection by individual ligation is infinitely preferable to attempted cautery pneumonectomy Even though external drain-

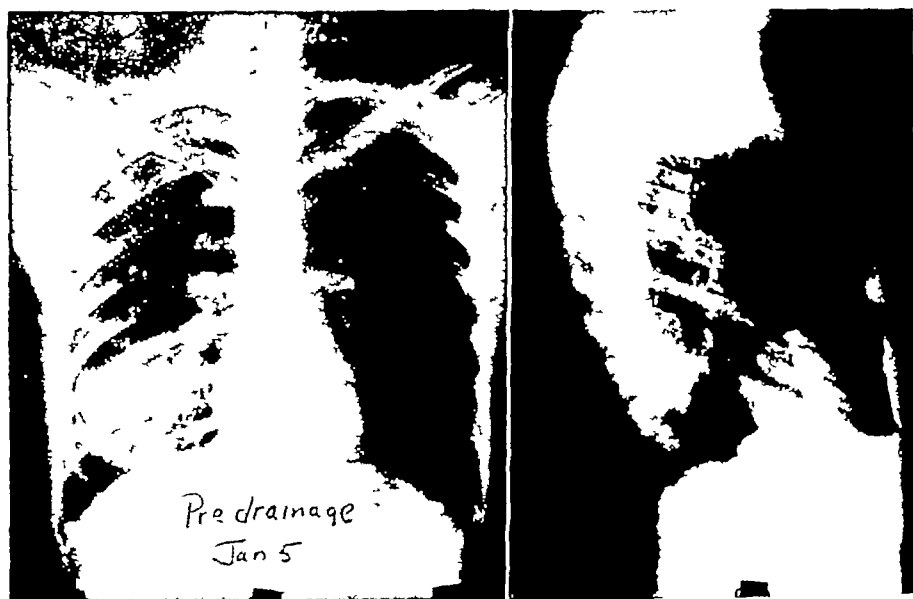


Figure 10, Case 4 Roentgenograms made in the frontal and right lateral projection prior to drainage There is a large round area of infiltration in the posterior subapical portion of the right lower lobe showing central rarifications

age has been attempted and failed resection still can be accomplished, although the hazard is increased somewhat because of the greater chance for intrapleural or wound infections. At operation, the draining sinus should be isolated, excised and inverted with separate instruments, before the chest is opened.

The following case is a good example of failure of cure by external drainage because of secondary changes in the lung. In this case total lobectomy was successful.

Case 4 This twenty three year old Mexican male was referred by Dr Gerald Scarborough. The patient originally was admitted to the hospital because of a six months' history of intermittent hemoptyses and productive cough which followed tonsillectomy. The initial roentgenogram showed a rounded area in the right lower lobe posteriorly with a central area of necrosis (Fig 10). Preliminary rib resection was done but a free pleural space was encountered. Later, further rib resection was performed and the cavity entered. A large amount of necrotic debris was removed and the cavity packed. The patient however coughed up blood repeatedly following the drainage procedure and bronchoscopy on two occasions showed blood clot in the right lower lobar bronchus. The abscess cavity appeared to be relatively clean but because of the hemorrhages further surgery did not appear to be warranted and the external sinus was allowed to close. Serial roentgenograms showed persisting patchy infiltration in the right lower lobe (Fig 11). Five months follow-

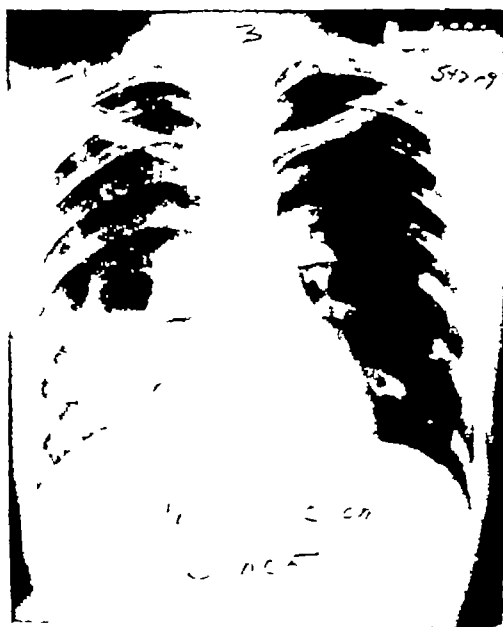


Figure 11 Case 4 Frontal roentgen film made just prior to lobectomy. The infiltration persists and seems to involve the right lower lobe somewhat more diffusely.

ing the original cavity drainage, a one-stage lobectomy by individual ligation technique was performed. The patient became ambulatory in five days and was discharged from the hospital in about three weeks. The operative specimen is shown in Figure 12.



Figure 12, Case 4 The right lower lobe has been sectioned through the long axis of the major bronchi. The diaphragmatic surface is to the right. Extensive bronchiectasis and pneumonitis are present. These findings readily explain why external drainage of the abscess was unsuccessful. The partially collapsed abscess cavity with overlying pleural adhesions can be seen at the left.

SUMMARY

1) The surgical aspects of acute and chronic pulmonary abscess have been discussed.

2) It has been emphasized that pulmonary abscess is a serious and unpredictable disease with ever-present surgical potentialities. It follows that early and frequent consultations between the physician and his thoracic surgical consultant are of the utmost importance.

3) It has been stressed that the arbitrary division of treatment of pulmonary abscess into medical and surgical aspects based on the length of illness is hazardous and has been largely responsible for the appalling mortality rates of past years.

4) The important role of bronchoscopy in improving "internal drainage" has been described.

5) The general indications for surgical drainage in pulmonary abscess have been given.

6) The pathological changes accompanying chronic pulmonary abscess have been briefly presented.

7) The indications for pulmonary resection (segmental lobec-

tomy, total lobectomy, total pneumonectomy) in the treatment of both drained and undrained chronic pulmonary abscesses have been discussed

8) Case histories have been presented which emphasize the salient facts

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RESUMEN

1) Se han discutido los aspectos quirúrgicos de abscesos pulmonares agudos y crónicos

2) Se ha recalcado que el absceso pulmonar es una enfermedad grave e imposible de pronosticar, que siempre posee potencialidades quirúrgicas. Por esta razón consultas tempranas y frecuentes entre el médico y su cirujano torácico son de suma importancia.

3) Se ha recalcado que la división arbitraria del tratamiento de abscesos pulmonares en aspectos médicos y quirúrgicos, basada en la duración de la enfermedad, es peligrosa y ha sido responsable en gran parte por la mortalidad alarmante de los años pasados.

4) Se ha descrito el importante papel de la broncoscopia en mejorar la "canalización interna."

5) Se han dado las indicaciones generales para la canalización quirúrgica del absceso pulmonar.

6) Se han presentado brevemente los cambios patológicos que acompañan el absceso pulmonar crónico.

7) Se ha discutido las indicaciones para la resección pulmonar (lobectomía segmentaria, lobectomía total, neumonectomía total) en el tratamiento de abscesos pulmonares crónicos, tanto canalizados como no canalizados.

8) Se han presentado historiales de casos que recalcan los hechos sobresalientes.

Bronchiectasis*

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Before the use of iodized oils, bronchiectasis was often not recognized. Numerous cases were incorrectly diagnosed as tuberculosis and unresolved pneumonia. At the present time a positive diagnosis can be made in almost every case. Bronchiectasis is an involvement of the lungs, the process may involve only a small portion of one lung, or in advanced cases may affect nearly all lobes.

There are two forms of bronchiectasis: congenital and the acquired. In the first type, deformities develop in fetal life by fibrosing bands and cysts and failure of expansion of the alveoli. The acquired form usually follows pneumonias associated with measles and whooping cough, and any condition which produces an atelectasis of an area supplied by a small or large bronchus. The frequent causes of atelectasis are foreign bodies in the lung, tumors of the bronchi, abscesses of the lungs, and extrinsic factors such as deformities of the chest wall, fluid in the chest, and tuberculosis. Cysts of the lungs, whether congenital or acquired, frequently precede the acquired form of bronchiectasis.

Congenital bronchiectasis is much more common in infants and children, but it is frequently overlooked until complications such as pneumonias occur. The acquired form of bronchiectasis in children is usually due to the aspiration of foreign bodies such as peanuts (arachidic pneumonitis). The foreign bodies produce atelectasis beyond the obstruction of the bronchiectasis. This is usually followed by an inflammatory process with or without abscess formation. Fibrosis of that portion of the lung develops in healing, and bronchiectasis frequently occurs. The pneumonias which follow scarlet fever, measles, chicken pox, and whooping cough predispose to bronchiectasis in children.

When bronchiectasis is found in an adult, the condition may have been of the congenital type, unrecognized for years, until acute inflammation occurs in or around the bronchiectatic area. But the usual acquired form follows, as in children, various types of pneumonias, aspiration of foreign bodies, mediastinal distor-

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tions, compression of the lung by fluid in the pleural cavity, thoracic deformities, and bronchial tumors, benign or malignant. Bronchitis, even with large amounts of secretion, rarely result in bronchiectatic dilatation.

Etiology of Bronchiectasis

Allergic bronchitis has been frequently considered as a precursor of bronchiectasis because of the bacterial infection that is engrafted on the allergic reaction. It is, however, a very uncommon cause of this disease. Spirochetal infection may cause a destruction of the mucous membrane, and even bleeding from the bronchi, which may be followed by dilatations. In this form of bronchiectasis one rarely finds the widely dilated bronchi of the true bronchiectasis. Silicosis is not uncommonly associated with bronchiectasis due to the fibrosis which is a secondary process. Nasal sinus disease has received considerable attention as a possible etiological factor. It is well known that there is frequent association of sinus disease and bronchiectasis. It is not likely that sinus disease itself will produce bronchiectasis, but when both conditions coexist it is likely that an acute flare-up of either one will influence the other. Tuberculosis is a common etiological factor especially in the chronic ulcerative type, but the amount of secretion which develops in this type is considerably less.

David T. Smith¹ suggested that the presence of fusiform bacilli and spirochetes in the bronchi may be an etiological factor in bronchiectasis. In some of his experimental work he was able to produce bronchiectasis in animals by the injections into the bronchial tree of the above organisms which he had cultured. Most men interested in this field of pathology feel that these organisms are secondary invaders.

Lipoid pneumonia is one of the less common factors in the development of bronchiectasis. This condition is more common in infants or older people who have aspirated oil into their lungs. The aspiration of mineral oil is the usual cause for oil pneumonitis; however in infants aspiration of milk or cod liver oil may also produce this disease.

Tumors of the bronchi, benign or malignant, may be followed by secondary inflammation of the pulmonary tissue, destruction of the bronchial walls, and bronchial dilatations.

Pathology

In congenital bronchiectasis there is a more or less orderly arrangement of the columnar epithelium, cartilage plates, and mucous glands. Evidence of inflammatory changes are either absent or slight. Multiple irregular lung cysts may be present, they are

distributed throughout the lung or may be localized in a single lobe due to the compression of the main bronchus, possibly by the duct of Cuvier ²

Cylindrical enlargements of the bronchi with atelectasis of the surrounding lung tissue is the usual type of involvement in congenital bronchiectasis. When abscess formation develops, due to pneumonic infection, one finds the usual pathologic appearance of the secondary process in addition to the primary lesion.

In the acute bronchial inflammation, changes usually occur in the bronchial walls. The infection may begin in the mucosa, followed by excretion of considerable mucus and pus. Aspiration of a foreign body may be followed by an infection of the bronchial tree, and fibrous strictures may occur, producing obstruction of bronchi with the resulting dilatation of the bronchial wall. Ulcerations of the bronchial wall and severe hemorrhages may occur if a large blood vessel is eroded. Considerable metaplasia may develop even to keratinization. Because of the strictures and destructions of the bronchial tree above the dilated portions of the bronchial tubes, putrifactive organisms have a suitable soil, and eventually may set up abscess and even gangrene of the lung. It is not uncommon that a broncholith may occlude a large bronchus, following which bronchial infection develops, abscess formation results, and a bronchiectatic area eventually develops. Pleural fibrosis develops in bronchiectasis only when there is secondary pneumonitis.

An acute form of bronchiectasis has been described recently by Brian Blades,³ particularly in the atypical forms of pneumonia. He found that the dilatations of the bronchi in the lower lobes disappeared after several weeks. The diagnosis of this condition was made after the injection of iodized oils into the bronchial tree. It appears that this type of bronchiectasis could not be due to the pathologic process described above, as the lesions could hardly disappear in so short a time. It is conceivable that there were relaxations of the bronchial walls due to an inflammatory process which later subsided, permitting the bronchi to dilate and contract normally (Figs 1 and 2).

Clinical Symptoms

Bronchiectasis may be present in two or more members of the same family. It is not uncommon in patients who have so-called "situs inversus." It is important to obtain a good history to determine whether the patient had suffered from pneumonia following chicken pox or whooping cough in childhood, or whether the patient had aspirated a foreign body at any time.

Cough is the most important and persistent symptom. It may

be a slight hacking cough with only slight expectoration, or violent paroxysms with large amounts of sputum, with or without a foul odor. The history usually shows that the cough has persisted for years, and frequently from childhood. The amount of sputum varies from a few cubic centimeters to as many as 1500 cc a day, and occasionally is streaked with blood. Hemorrhages are more frequent in the advanced cases than in tuberculosis, and occasionally fatal hemoptysis occurs. The odor of sputum at times is so vile that the patient becomes an outcast. In rare instances, bronchiectasis may be present without cough or symptoms, but

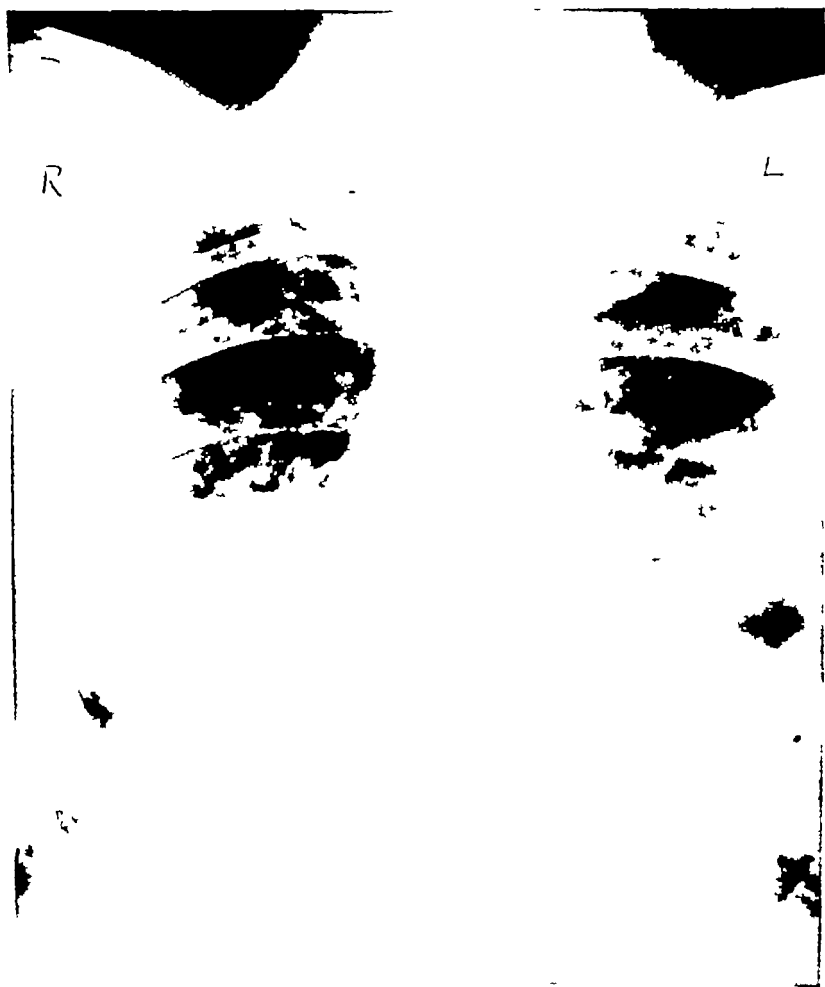


Figure 1. Roentgen film of patient with lipoid pneumonia. In the left cardiophrenic angle one can see a bronchiectatic atelectatic lobe. In the right base there is a diffuse haziness which proved to be pneumonic consolidation and fibrosis (See Figure 2).

lung hemorrhages occur Studies with iodized oil and roentgen films show the bronchiectatic dilatations, typical of the disease This has been called the dry bronchiectasis by Bezancon and his associates⁴ This particular type of disease has been frequently mistaken for tuberculosis, but the absence of tubercle bacilli in smears, cultures and guinea pig inoculations rule out this disease

Bronchiectatic patients often experience fever, sweats, and chills These episodes frequently occur with attacks of pneumonitis which develops as a result of the spread of the infection from the bronchial tubes through the lymphatic channels to contiguous lung tissue Pain in the chest is unusual unless there is pneumonia or pleurisy Constitutional symptoms may be slight for long periods of time unless acute "colds" or acute sinusitis develops In long-



Figure 2 Photograph of left lung on sagittal section Left upper lobe is emphysematous, left lower lobe shows bronchiectatic atelectasis Note the dilated bronchi in this area

standing cases dyspnea is not an unusual symptom, due to emphysema and cor pulmonale Osteoarthropathy is a common accompaniment to bronchiectasis

Physical Signs

In bronchiectasis the physical signs depend on the amount and location of the involvement In the bronchiectatic, atelectatic cases, compensatory emphysema develops, and surrounds the affected lobe This masks the signs that can be elicited by auscultation and percussion

In other cases, impaired resonance is found over the diseased area Rales are heard, depending on the size of the involved bronchi and the amount of secretion in the tubes In patients who have large amounts of sputum retained in the bronchial dilatations, diminished breath sounds are noted, but when the patient is given postural drainage or has a violent cough with much expectoration, bronchial breath sounds are heard The whisper sounds at this time are usually markedly increased, due to consolidation of lung tissue At other times, practically normal breath sounds and percussion notes are elicited Roentgen ray studies, both by fluoroscopy and films are the best means for the demonstration of the true character of the lesion

Roentgen Ray Findings Fluoroscopy and Films

In the fluoroscopic study of bronchiectasis it is possible to inspect the shadows of the lung normal and abnormal, the position of the heart, mediastinum and diaphragm One can visualize the varying degrees of air-containing lung and also note emphysematous areas (hyper-aeration) It is important to view the patients from various angles, and it is possible to throw the cardiac shadow away from densities lying in the same planes By this means, one can frequently see triangular shadows of bronchiectatic, atelectatic areas which are hidden in the posterior anterior position One can also note the movements of the diaphragm and the various densities which appear as a result of the inflammatory process The x-ray film makes a permanent record of changes which have been



Figure 3 Schematic drawing showing the various types of bronchiectatic conditions 1) Grape 2) Clubbing 3) Cylindrical 4) Saccular 5) Bead formation

found on fluoroscopic study, and it is advisable not only to take stereoscopic films, but also tangential and true lateral. Even with these films, bronchiectatic areas may not be visible without the use of iodized oil instillations into the bronchial tree (Figs 3 and 4)

Iodized Oil Injections into the Bronchial Tree

There are several methods of introducing iodized oil (40 per cent). The simplest one is the injection into the pharynx of 20 cc of warmed iodized oil while the patient's tongue is pulled out as far as possible. In many instances, this can be done without the



Figure 4 Bilateral bronchiectasis showing various types of dilatations shown in Figure 3 (Iodized oil injection)

use of local anesthesia. When a patient has a sensitive pharynx, it is advisable, preliminary to the injection, to use 10 per cent cocaine solution as a local anesthetic (Fig 5)

Some of the other methods which are in use are the following: Injecting the oil through a tracheal catheter after the use of a local anesthetic, through a nasal catheter, and through a tube introduced through a bronchoscope directly into the desired bronchus. The author has found that lipiodol (Lafay), which contains 40 per cent by weight of iodine combined with poppy seed oil, has been the most effective.

Not all the iodized oil is expectorated, and may be retained in the alveolar structures for years. It is rare for complications to arise, but patients sensitive to iodine may develop iodism (nasal discharge, congestion of the conjunctiva, and even slight fever and headache). These symptoms disappear within a few days. On rare instances, the oil has been found to block a bronchus and produce atelectasis of a portion of the lung.

When the sputum is emptied into a specimen glass, it separates into three layers. Elastic fibers are rare unless there is a marked degeneration of lung tissue. A microscopic examination shows degenerated, blocked cells, crystals, and fatty acids, lymphocytes

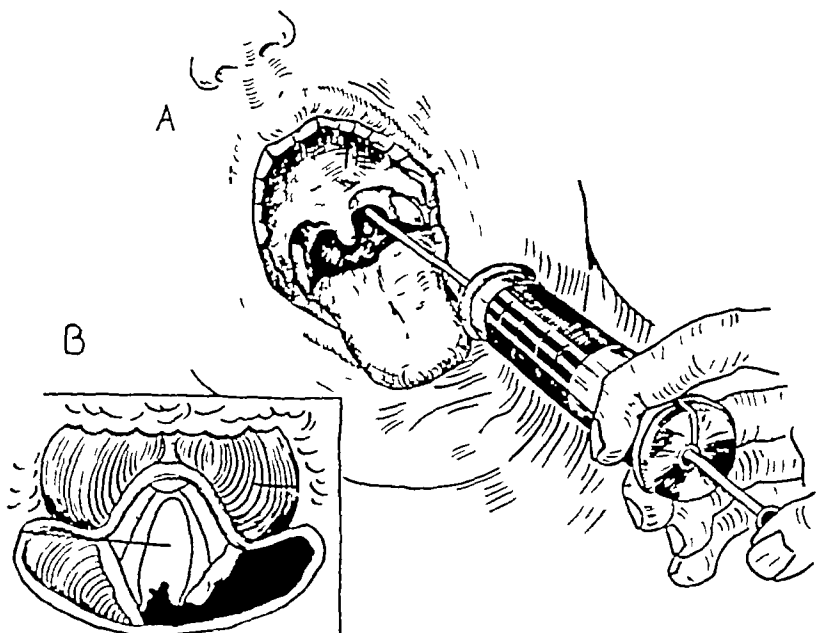


Figure 5 (A) Simple method of introducing iodized oil into the bronchial tree. Straight tip of cannula is positioned midway between the uvula and the tonsil. The tongue is extended as far as possible while the patient is breathing deeply. (B) Iodized oil shown in the inter-arytenoid fossa and overflowing into the bronchial tree when the vocal cords are separated.

do not predominate Yeast cells are not an uncommon contaminant The various micro-organisms, such as staphylococcus aureus, micrococcus catarrhalis, B mucosus-capsulatus, hemolytic streptococcus, pneumococcus, streptococcus viridans, and fusiform bacillus are the most common bacteria found in the various diseases associated with and predisposing to bronchiectasis Numerous studies of the sputum for acid fast bacilli should be made, both by concentration method, guinea pig inoculation and culture, to determine whether tuberculosis is present

The sedimentation test is usually rapid when acute exacerbations take place This test is not as valuable as in tuberculosis, but is an indicator of the virulence of the bacteria present

Treatment of Bronchiectasis

Until recent years, the treatment of bronchiectasis has been palliative Before definite diagnostic procedures were available, the majority of persons afflicted with bronchiectasis were treated as tuberculous patients in sanatoria It is now recognized that the surgical removal of the diseased lobe or lobes, when feasible, is the only effective cure for bronchiectasis Unfortunately, many patients present themselves too late for operative procedures There are benefits, however, to be obtained from medical treatments, particularly postural drainage, heliotherapy, intravenous therapy, direct intrabronchial application of drugs, inhalation of vapors, bronchoscopy, and abdominal belts Of lesser importance is the question of rest, diet, and climate The benefits derived from the above treatments are an amelioration of cough, lessening the amount of sputum, and decrease in the frequency of attacks of pneumonia

Postural Drainage In the advanced cases of bronchiectasis, most patients have found by practical experience the best positions to assume in emptying their lungs, and it is not unusual for patients to bring up from 500 to 1000 cc at one time This copious discharge relieves the patient of considerable cough which is necessary to bring up sputum, and in that way, they save much wear and tear

The methods of postural drainage are simple The patient may be placed on a chair with his head down and his hands on the floor, or be placed on a teeter-totter used by children, where he can be inclined at any angle for a few minutes at a time For very sick patients, a postural drainage bed has been devised by the author Without any effort on the part of the patient, the bed may be placed at any incline by moving certain levers and ratchets on the bed ⁵ A drainage should be done two or three times a day, preferably in the early morning and before retiring The

symptomatic relief which frequently follows postural drainage is dramatic, and patients may go about their business or pleasure for long periods of time without any great discomfort (Fig 6)

Heliotherapy Heliotherapy has not been effective in reducing the amount of secretion. Patients may feel better generally by exposure to sunlight in moderation. The artificial sunlamps are sometimes beneficial. The application of heliotherapy should be started a few minutes at a time and gradually increased, so that the patient may be exposed for several hours. It has never been quite fully understood how results may be obtained, but clinically it has been found that some patients do improve.

Intravenous therapy—nearsphenamine This drug has been used in the same way as in the treatment of syphilis, and occasionally one sees a lessening of symptoms, particularly in the reduction of the amount of sputum and the disappearance of its foul odor. It may be used in patients who show the spirochetes and fusiform bacilli in the sputum. Postural drainage should always be used in conjunction with this therapy.

Intrabronchial application of drugs Iodized oils and brominized oils (in those patients who are especially sensitive to iodine) may be introduced directly into the bronchial tree. The value of these oils is not in their iodine or bromine content, but rather in the displacement of the purulent secretion. It also mechanically coats the mucous membranes of the bronchial tree and thus prevents irritation of the mucous lining. One of its effects is to dilute the

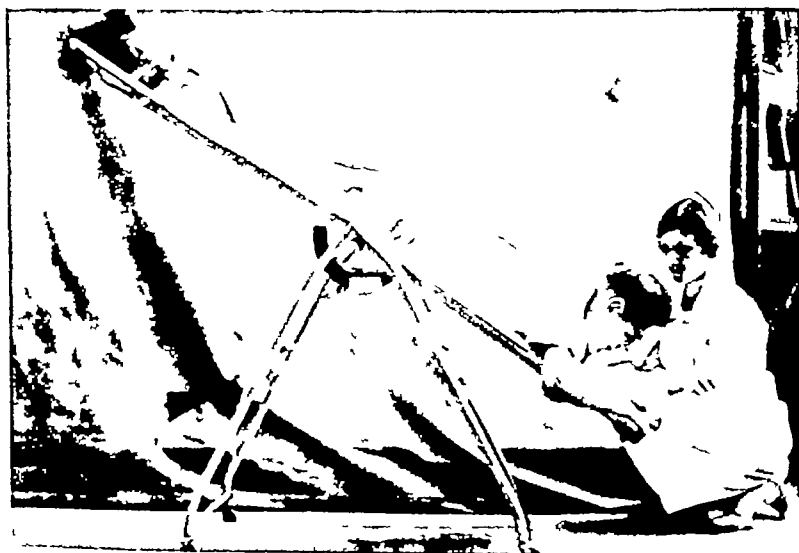


Figure 6 Postural drainage table. Patient can be adjusted to the most suitable position for emptying the bronchi.

secretion so that it may be coughed up easier Ten to twenty cubic centimeters of oil may be injected once a week, and it should be warmed to body temperature before it is introduced This treatment should not be kept up for more than four weeks if the results obtained do not warrant it The methods of instillation of the oil have been described previously

Inhalations of medicated air Until 1941 the use of medicated air and volatile drugs had been of only the slightest value in the treatment of bronchiectasis At that time M R Castex⁶ suggested the use of a nebulized preparation of sulfathiazole in the bronchial tree He reported good results in the treatment of suppurative conditions of the lung Several other authors, particularly Stacey,⁷ Harris,⁸ and Edlin,⁹ have written on this subject Sulfathiazole (5 per cent) in a normal saline solution is used as a spray This is given daily over long periods of time A lessening of the purulent discharge was noted, but the pathologic status of the involved lung remained

A renewed interest has developed in the use of aerosol with penicillin since the published work of Bryson, Sansome, and Laskin¹⁰ in 1944 These authors found that penicillin aerosol penetrated the lungs, diffused into the blood stream, and was excreted in the urine Barach¹¹ and his co-workers suggested the use of penicillin in a normal saline solution to be used as the vehicle for penicillin inhalation Vermilye¹² used Barach's method of treatment on 200 patients suffering from upper respiratory conditions, and reported excellent results Nebulization of the penicillin was obtained with the use of an oxygen tank attached to a Vaponephrin nebulizer "A Y tube is inserted at some point in the rubber tubing, one arm of the Y being left free The aperture at the top may be attached to the original nebulizer, at the carburetor, this permits some economy in the use of penicillin, but is not essential"

Vermilye found that the calcium salt of penicillin makes a superior aerosol, is less likely to cause cough, and is more agreeable because it has less odor The dose most used for adults was 25,000 units in 1 cc, but larger doses may be used From three to five treatments daily can be given to ambulatory patients, and for those too ill the large oxygen tank with the spray at the bedside is used

It has been recommended by Segal and Ryder¹³ that bronchiectatic or lung abscess patients be given a preliminary treatment for at least a week of several inhalations of penicillin per day before operation Olsen¹⁴ has also used this type of preparatory treatment for lobectomies and has used as high as 75,000 units of penicillin per day Streptomycin is now being tested in a similar

manner Sturner¹⁵ suggested that a small amount of epinephrine added to the penicillin mixture would shrink the mucous membranes and thus open the passages for the distribution of the penicillin aerosol and also to prolong its action

Barach¹¹ and his co-workers reported that the absorption of penicillin into the blood and its recovery from the urine is not necessarily a measure of the effectiveness of the drug. It is their opinion that penicillin spray exerts its bactericidal effect by contact with the organisms

Penicillin has been used intratracheally by Kay and Meade, Jr.¹⁶ They used from three to five cubic centimeters of saline solution of the sodium penicillin up to 10,000 units per cubic centimeter. They later increased the strength to 50,000 units daily at one application. The blood penicillin is reported as high as 0.03 Oxford units. In a series of 45 patients with bronchiectasis they found clinical improvement after four to five days, but in the minimal diseases obtained almost complete relief of symptoms. In a series of 50 lobectomies for bronchiectasis in which penicillin was used, as compared with 25 lobectomies in which this drug was not used, no difference was noted in the pathologic study of these specimens. However, these authors concluded that those patients who had had the penicillin treatment before lobectomy recovered more promptly and did have fewer complications.

Romansky, Dugan, and Rittman¹⁷ described still another method for the introduction of penicillin into the lung. They used a preparation of calcium penicillin blended with iodized oil which was introduced directly into the bronchial tree. Every cubic centimeter contained 1500 Oxford units of penicillin. The fluoroscopic picture showed the exact location of the injected oil.

Bronchoscopy Bronchoscopic drainage of secretions from the bronchial tree has been practiced by a great many physicians. Its value for diagnosis is not disputed, but no eventual cure has ever been described. It is possible by the use of the bronchoscope to dilate strictured bronchi and remove granulation tissue, thus permitting better drainage. Bronchoscopy is not a pleasant procedure, but patients adapt themselves and will permit bronchoscopic drainage because of the great relief frequently obtained. If benefits are not derived within the first few months, it is not advisable to continue with this form of treatment. Along with bronchoscopy, simple postural drainage should be used two to three times daily.

Abdominal belts Abdominal belts with a compression device to keep the diaphragm high have been of some slight benefit to patients with lax abdominal walls. The cough is more effective and the purulent secretions are expectorated easily.

Surgery of Bronchiectasis

The surgical approach to the treatment of bronchiectasis is firmly established. The mortality rate which was somewhere between 50 and 60 per cent previously is now about 3 per cent. Patients who are submitted to surgical treatments should be in good general condition, preferably under 40 years of age, there should be no evidence of amyloidosis and not too much involvement of both lungs. The present surgical approaches to the treatment of bronchiectasis are by pneumonotomy, lobectomy, and total pneumonectomy.

Pneumonotomy Pneumonotomy can be used when there are multiple lung abscesses as a complication of bronchiectasis, and where adhesions are so firmly established that it would be too dangerous to attempt pneumonectomy. The operation can be done either with the electric cautery or the actual cautery.

Lobectomy Lobectomy is now the operation of choice. In the hands of skilled operators it has a low mortality. The original operation as described by Shenstone¹⁸ gave good results. However, with the individual ligation of each vessel at the hilus, as suggested by Kent and Blades,¹⁹ the complications and mortality rates have been even more decreased. It is important that not only the diseased lobe be removed, but the lingula, when affected, must be likewise taken off. Many patients who had been doomed to a life of misery and who were outcasts have been rehabilitated and have become useful members of society.²⁰ It is unfortunate that so many patients present themselves too late in the disease for successful lobectomies.

Total pneumonectomy ²¹ The removal of the entire lung when disease is far advanced is now feasible with the newer techniques devised for pneumonectomy are used. This operation can only be done by skilled thoracic surgeons who are now available in our large medical centers.

SUMMARY

It is evident that until recent times bronchiectasis was frequently diagnosed as pneumonia, tuberculosis, carcinoma, fungus disease of the lung, abscesses, or fibrosis from many causes. But with the methods for definite diagnosis now available, the true character of bronchiectasis is recognized early and suitable treatment may effect cures in a large percentage of patients. The most important conditions giving rise to bronchiectasis are the pneumonias following exanthematous diseases, aspiration of foreign bodies into the lung, and the presence of tumors or cysts which block bronchi, producing atelectasis.

The medical treatments are at best palliative, but sometimes patients may feel clinically well although the pathologic condition remains. Surgery offers positive cures, particularly for young patients. Thoracic surgeons are now available in all medical centers. At the present time, the mortality rate is low, and one should not hesitate to have a lobectomy or pneumonectomy done in suitable cases. The best type of clinic for the study and treatment of bronchiectasis is a chest service, where a chest physician, bronchoscopist, roentgenologist, and thoracic surgeon work as a team.

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RESUMEN

Es evidente que hasta tiempos recientes se diagnosticaba frecuentemente la bronquiectasia como neumonía, tuberculosis, carcinoma, enfermedad fungica del pulmón, abscesos o fibrosis debida a muchas causas. Pero con los métodos que ahora existen para el diagnóstico bien definido, se reconoce tempranamente el verdadero carácter de la bronquiectasia, y el tratamiento apropiado puede efectuar curaciones en un alto porcentaje de pacientes. Los estados más importantes que producen bronquiectasia son las neumonías que siguen a las enfermedades exantemáticas, la aspiración en el pulmón de cuerpos extraños y la presencia de tumores o quistes que obstruyen los bronquios y producen atelectasia.

Los tratamientos médicos son a lo más paliativos, pero los pacientes pueden a veces sentirse clínicamente bien, aunque persista la condición patológica. La cirugía ofrece curaciones positivas, particularmente a los pacientes jóvenes. Hay actualmente cirujanos de tórax en todos los centros médicos. Al presente la mortalidad es baja, y uno no debe vacilar en someter casos apropiados a la lobectomía o neumonectomía. El mejor tipo de clínica para el estudio y tratamiento de la bronquiectasia es un servicio de tórax donde el médico del pecho, el broncoscopista, el roentgenólogo y el cirujano de tórax, cooperan mutuamente.

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Calcium Ribonate and Vitamin C (Nu 240-10) in the Treatment of Tuberculosis

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The object of this paper is to show that the use of calcium ribonate and vitamin C in the treatment of tuberculosis is definitely indicated. The total serum calcium concentration varies normally from 9 to 11 mg per 100 cc. It is important to note that the absorption of calcium is governed by these factors: 1) The hydrogen-ion concentration within the intestines; 2) The relative proportion of other substances in the diet; 3) Vitamin D.

Calcium metabolism is easily altered in febrile tuberculous patients because of poor nutrition, of deficiency in free hydrochloric acid, of depressed digestive processes, of reduced alkalinity of the blood and of increased elimination of calcium on account of exudative inflammatory processes.

It is a known fact that in all exudative lesions there is an increase of H-ion concentration in the affected tissues with a relative decrease of calcium. It has also been shown that patients with exudative lesions eliminate more calcium than is ordinarily eliminated under normal conditions. As the result of inflammation, the capillaries become dilated and more permeable, hence serum and its constituents pass into the paravascular spaces. In acute inflammatory conditions this exudate is readily re-absorbed and the tissues involved are restored to their normal state. In chronic inflammation however, some of the exudate remains stagnant and the blood cells found there are eventually disintegrated.

In the presence and action of calcium, the exudate of the paravascular spaces is converted into two histological elements, 1) the matrix, and 2) the fibrils. Eventually these fibrils unite through a process of fusion and later form white waxy bundles of non-elastic fibres. Without the action of calcium the formation of fibrils and fibrous tissue would not take place any more than the

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The material used in this work was furnished by Hoffman-LaRoche Inc., Nutley, New Jersey.

coagulation of blood in the absence of calcium. Therefore, calcium deficiency is to be considered as a serious handicap for tuberculous patients, inasmuch as it plays such an important part in the formation of fibrous tissue, the forerunner to the healing of some tuberculous lesions.

Since calcification of a pulmonary lesion is considered to be an indication that the process is healed, numerous attempts have been made to promote calcification of these lesions by some form of calcium therapy. Gordon and Cantarow¹ administered parathormone, 20 units every 48 hours, and calcium lactate, 30 grains three times daily, to 14 patients with pulmonary tuberculosis for periods of one to six months. Roentgenographic studies failed to reveal any change in calcification of the lung fields or bones of the hand. They maintained that calcium may exert a beneficial effect upon certain symptoms. Excessive bronchial secretion may be lessened, with consequently diminished cough, the pain of acute pleurisy may be relieved by intravenous or intramuscular injections of calcium gluconate or by parathormone, serobifrinous pleurisy may be benefited.

Menkin² noted that approximately 10 times as many calcified areas were found in rabbits injected with calcium chloride than in the control animals. Spies³ demonstrated that repeated administration of viosterol caused calcification of tubercles. Scholtz⁴ gave intramuscular injections of calcium gluconate every second day to 22 patients with exudative tuberculous lesions. This therapy exerted a marked influence on exudation for in 80 per cent of the patients the quantity of sputum decreased rapidly. In many cases the night sweats were favorably influenced. He concluded that the effect of calcium therapy is not due to a specific influence upon the tuberculous process but rather to its vascular action, diminishing capillary permeability and inhibiting inflammatory exudation.

Many writers have recommended the use of calcium in patients with pulmonary tuberculosis, particularly those receiving pneumothorax and those with intestinal tuberculosis. Pisani and Smejkal⁵ reported favorably on the prevention of pleural effusions by the use of calcium.

Calcium is of undeniable value in the treatment of diarrhea in intestinal tuberculosis. Brown and Sampson⁶ said it was about the best remedy for this purpose. Cantarow⁷ suggested that calcium therapy for the diarrhea of intestinal tuberculosis is beneficial because of its inhibitory action on peristalsis and general dehydrating effect. In any event, it has a tendency to relieve abdominal pain, intestinal bleeding and diarrhea in most cases. Pisani⁸ in his treatment of 43 cases of intestinal tuberculosis with

intramuscular injection of calcium gluconate found that 20 were definitely improved. Calcium therapy in the majority of cases can bring about changes which tend to rectify the disturbed physiological activity of the intestines.

According to Pisani, the use of calcium for intestinal tuberculosis is of importance because it restores the normal calcium ion concentration of the tissues, it stimulates phagocytosis, stimulates fibrosis and it counterbalances the existing vagotonia through stimulation of the sympathetic filaments. The importance of an early diagnosis of intestinal tuberculosis cannot be overestimated. We doubt if far advanced tuberculous intestinal lesions are amenable to any treatment.

It is generally agreed that the most important function of vitamin C is control of the intercellular cement substance in connective tissue. In this connection, it is of vital importance to tissues of mesodermal origin such as collagen, vascular endothelium, cartilage, and the matrices of bone. Most authors maintain that there is a deficiency of vitamin C in tuberculous patients. Some have shown a rough parallelism between the severity of the tuberculosis and the degree of vitamin C deficiency. In normal individuals the blood-serum level of ascorbic acid is between 0.7 and 2.5 mg per 100 cc. Elimination of vitamin C from the diet is followed by a gradual fall in the blood level of the vitamin until it reaches a value as low as 0.2 mg per 100 cc. The urinary excretion of vitamin C in the normal healthy subject is dependent upon the dietary intake.

Faulkner and Taylor⁹ have shown that there is an increased demand for vitamin C in infection. Patients with tuberculosis required more than 200 mg of ascorbic acid a day to keep the plasma level normal. This is to be compared with 25 to 60 mg which is considered to be the daily requirement of a normal adult. Kaplan and Zonnis¹⁰ have shown that the vitamin C concentration in the blood can be raised in most patients to normal levels by the oral administration of synthetic vitamin.

Singer and Van Bark¹¹ report that the ordinary balanced hospital diet in itself is adequate in maintaining a vitamin C equilibrium in a large percentage of tuberculous children. Studies controlled feedings of 50 to 100 mgm of vitamin C daily were followed by a rise in the ascorbic acid values of blood plasma to normal or high levels. Bumbalo and Jetter¹² have shown a comparison of the excretion of vitamin C between tuberculous and nontuberculous children. In the first place, the average basic level of the urinary excretion of vitamin C in the two groups varied considerably. The tuberculous group consistently excreted less than 10 mg per 24 hours. On the other hand, the control

groups of healthy children excreted on the average of 30 to 35 mg per 24 hours. As far as could be ascertained, the vitamin C intake of this latter group was approximately similar to that of the tuberculous group, showing that such a diet in a healthy child is adequate, but in one with a chronic infection such as existed in the tuberculous group, it was insufficient.

In consideration of the above-mentioned factors, we have employed at the Boston Sanatorium a combination of calcium ribonate and vitamin C on a series of 50 cases. The preparation was supplied in ampules of 10 cc containing a 10 per cent solution of calcium ribonate buffered with sodium ascorbate. This new calcium salt is water-soluble to the extent of approximately 70 per cent. It is ionized slowly, and it is believed that in metabolism the acid radical is probably oxidized. Maddock¹³ has shown that the intravenous administration of this product on parathyroidectomized and normal dogs, possesses a more prolonged hypercalcemic effect than calcium gluconate. All of our patients received 10 cc of calcium ribonate intravenously, three times weekly for a period of three months (Table I).

Intestinal Tuberculosis

Our first group consisted of 11 patients, ranging from 18 to 56 years of age, with intestinal tuberculosis. Eight of the patients were females and three were males. The main symptoms presented by this group were diarrhea, abdominal pains, dyspepsia, occasional vomiting, loss of appetite and weight. Four patients failed to respond to ultraviolet therapy. We were able to note a definite improvement in five patients after three months' treatment with calcium ribonate. There was no change in one case and there were five deaths.

TABLE I
The Results of Calcium Ribonate Therapy in Tuberculosis

Cases	No of Patients	R E S U L T S		
		No Change	Improved	Dead
Intestinal Tuberculosis	11	1	5	5
Pleural Effusion Following Pneumothorax	10	1	9	0
Pre-Pneumothorax	10	No Fluid in 8 Cases		0
Empyema	6	3	2	1
Far Advanced Pulmonary Tuberculosis	13	2	9	2

Case 1 S.C., a 48 year old, white, married female was admitted with a positive sputum and far advanced pulmonary tuberculosis. Roentgenograms of the chest revealed infiltration and moderate broncho-pneumonic reaction involving the entire left lung with a large cavity in the left apical area. The patient was admitted with a two-months' history of cough, expectoration, night sweats, loss of appetite, and 17 lb. in weight. After one week's hospitalization the patient began to complain of abdominal pains, nausea, and diarrhea ranging from 6 to 10 bowel movements a day. Roentgenograms of the gastro-intestinal tract revealed the presence of intestinal tuberculosis. The patient was placed on calcium ribonate therapy and after 6 weeks' treatment her diarrhea, nausea, and abdominal pains had disappeared. At the end of three months treatment, the patient had gained 22 lbs. A left thoracoplasty is to be performed in the future.

Pleural Effusion Following Pneumothorax

Our next group consisted of 10 patients ranging from 16 to 42 years of age, who had developed a pleural effusion during the course of their pneumothorax. Six of the patients were females and four were males. The pleural effusion had existed anywhere from 2 months to 9 months. On calcium ribonate therapy, we were gratified to note that the fluid disappeared in 9 cases and there was no change in one case which required thoracentesis.

Case 2 N.B., a 16 year old single white school girl, was admitted with a positive sputum and moderately advanced pulmonary tuberculosis. Roentgenograms revealed infiltration and moderate broncho-pneumonic reaction involving the upper half of the right lung. The patient was admitted with a 6 weeks' history of cough, expectoration, loss of appetite and 10 lbs. in weight. A right artificial pneumothorax was instituted and a good collapse was obtained. Three weeks following the initial pneumothorax, the patient developed a right pleural effusion. The patient was placed on calcium ribonate therapy and the pleural effusion completely cleared after 5 weeks treatment. The patient has since been discharged from the sanatorium.

Prepneumothorax

We selected for our next group 10 patients ranging from 18 to 38 years of age, who were to be given pneumothorax therapy. Seven of the patients were females and three were males. Calcium ribonate was administered one month prior to pneumothorax and continued for 2 months during their refills. We noted that only 2 of the 10 patients developed fluid. In a control group of 10 cases, six patients developed fluid.

Case 3 C.C., a 20 year old, white, single student nurse, was admitted with a positive sputum and minimal pulmonary tuberculosis. Roentgenograms revealed infiltration and moderate bronchopneumonic reaction in the region of the 1st right interspace. The patient was admitted with a 7 weeks history of slight cough, fatigue and 5 lb. weight loss. A right pneumothorax was advised. One month prior to receiving pneu-

mothorax, the patient was placed on calcium ribonate therapy and this was continued for two months. She has been receiving right pneumothorax for 16 months with no evidence of fluid in the pleural cavity.

Tuberculous Empyema

Our next group consisted of 6 patients, ranging from 21 to 39 years of age, with tuberculous empyema. Four of the patients were male and two were female. These patients had thoracenteses on the average of every 2 weeks. After three months of calcium ribonate therapy, we noted that there was definite improvement in three patients, in that the fluid became less viscous and the amount of fluid decreased requiring less frequent thoracenteses. No change was seen in two cases and one patient died.

Case 4 T.C., a 21 year old, white, single female was admitted with a positive sputum and moderately advanced pulmonary tuberculosis. Roentgenograms revealed infiltration and small cavity in the right upper lobe. The patient was admitted with a 2 months' history of cough, expectoration, weakness, and loss of 17 lbs in weight. A right pneumothorax was instituted and after 5 weeks' treatment the patient developed a tuberculous empyema. The patient was tapped on the average of once every 2 weeks for a period of 3 months. On each thoracentesis from 20 to 30 oz of greenish-yellow fluid was obtained. The patient was placed on calcium ribonate therapy and after 3 months' treatment the fluid practically disappeared. She has not been tapped for 4 months and has since been discharged from the Sanatorium with a negative sputum and partial atelectasis of the right lung.

Far Advanced Pulmonary Tuberculosis

Our next group consisted of 13 patients ranging from 27 to 52 years of age with far advanced pulmonary tuberculosis. Nine of the patients were males and four were females.

The majority of these cases had been in the sanatorium from 6 months to 2 years. None of these patients were considered suitable for collapse therapy. After 3 months treatment on calcium ribonate we found that 9 patients were definitely improved. Decrease in night sweats, lessening of cough, and improvement in appetite were especially noted. In 2 patients there was no change and 2 patients died.

Case 5 H.P., a 31 year old, white, married male was admitted with a positive sputum and far advanced pulmonary tuberculosis. Roentgenograms revealed soft infiltration and moderate bronchopneumonic reaction with multiple small cavities involving both upper lobes. The patient was admitted with a 4 months' history of cough, expectoration, weakness, loss of appetite and 12 lbs in weight. Due to the patients' clinical condition and extensive disease, no collapse therapy could be undertaken. After 3 months' treatment on calcium ribonate a definite improvement in the patients' cough, strength, and appetite was noted. He gained 20 lbs in weight. The patient has recently been started on pneumoperitoneum treatments.

No ill effects or untoward symptoms were noted in the intravenous administration of calcium ribonate

In view of the findings of many workers in tuberculosis and our own experience, we believe that the use of calcium ribonate and vitamin C has a definite place in the treatment of tuberculosis particularly intestinal tuberculosis and pleural effusion

SUMMARY

1) The writer's observations as well as other investigators' have revealed that there is a definite use for calcium and vitamin C therapy in the treatment of tuberculosis

2) In a series of 50 cases at the Boston Sanatorium a combination of calcium ribonate and vitamin C was administered intravenously three times weekly for a period of three months

3) The results obtained justify the continued use of calcium ribonate and vitamin C in the treatment of tuberculosis, especially intestinal tuberculosis and pleural effusions

4) No ill effects were encountered in the intravenous administration of calcium ribonate in any of our cases

RESUMEN

1) Las observaciones del autor, lo mismo que las de otros investigadores, han revelado que existe un uso bien definido para la terapia con calcio y vitamina C en el tratamiento de la tuberculosis

2) En una serie de 50 casos en el Sanatorio de Boston se administró una combinación de ribonato de calcio y vitamina C por la vía intravenosa tres veces a la semana por un período de tres meses

3) Los resultados obtenidos justifican el uso continuado del ribonato de calcio y vitamina C en el tratamiento de la tuberculosis, especialmente tuberculosis intestinal y derrames pleurales

4) La administración intravenosa del ribonato de calcio no causó efectos contraproducentes en ninguno de nuestros casos

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Cystic Disease of the Lung with Report of a Case*

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The problem of cystic disease of the lung has received increased notice in the literature since 1925 when Koontz¹ reported a case and analyzed 108 others, all of which were found in the foreign literature Wood² in 1934 added a series of 16 from the Mayo Clinic Sellers³ in 1939 collected well over 400 cases Recently Edwards and Ehrlich⁴ found two cases of lung cyst in a study of about 13,000 inductees and National Guardsmen in New York City which is a fair estimate of the relative infrequency of the condition In the past eight years six cases of cystic disease were seen at the Department for Diseases of the Chest of Jefferson Hospital, one of which will be discussed in detail

The term cystic disease has been applied to a wide variety of abnormal localized distensions of the parts of the bronchial tree and pulmonary parenchyma, such as congenital cystic disease of the lung, acquired cystic disease of the lung, cystic bronchiectasis, bulbous emphysema, pleural blebs, and pulmonary pneumatoceles This diverse terminology has arisen through the efforts to explain its pathogenesis

There are two schools of thought as to the etiology of cystic disease, one considers it congenital and the other, acquired The theory of congenital cystic disease is supported by the finding of lung cysts in the fetus and newborn, the frequent association with other congenital abnormalities such as dextrocardia, congenital heart disease and polycystic kidney, and their occurrence in accessory or abnormal lobes of the lung Some of the supporters of this theory believe that the cyst formations are the result of an arrested development of the bronchial tree while others attribute this pulmonary anomaly to inflammatory processes occurring during intra-uterine life However, recent reports showing development of cystic disease following infection suggests their acquired nature It appears likely that both types do occur

Pathologically, cystic disease can be divided into two groups according to the presence or absence of epithelial lining The epithelialized can be congenital or acquired In the congenital, the

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wall contains bronchial elements such as cartilage, glands, smooth muscle fibres and the epithelium is bronchial in type (stratified ciliated) The acquired usually does not have cartilage or muscle in the wall and the epithelization results from the ingrowth of epithelium from the bronchial fistula The non epithelialized has a wall consisting merely of connective tissue without epithelium, no bronchial elements being present

Clinically, two main forms of cysts can be distinguished, the solitary and the multiple⁵ Single cysts may be of two types—a large solitary balloon cyst or the small solitary cyst about the size of an orange This single cyst may lie within the parenchyma of the lung, or it may occupy the site of a whole lobe, or it may arise from other structures to which it is developmentally attached, such as the trachea or esophagus The multiple form is more common and consists of numerous small cysts representing a more or less diffuse cystic appearance of larger or smaller parts of the lung They vary greatly as to size, distribution, type of bronchial communication and nature of content They are often confined to one lung but may be distributed in both

Numerous theories have been advanced as to the mechanism of production of lung cysts Oughterson and Jaffel⁶ give a comprehensive review of the subject and conclude that varying degrees of bronchial obstruction plays a major part The large size of the solitary cyst can be explained on the basis of a check valve

The clinical picture depends on the type of cystic disease present The large balloon type of cyst produces symptoms early It may contain air or fluid or both and can be the site of superimposed infection resulting in pus and surrounding pneumonitis It is most commonly found in infants and may produce such distension within the thorax that respiratory and circulatory embarrassment results from the shift of the mediastinum and collapse of the displaced lung It may persist into adult life in an asymptomatic form and be detected accidentally or due to rupture or infection Smaller solitary cysts are usually silent and only discovered during some respiratory disease necessitating x-ray study Multiple cysts are usually silent clinically so long as they are sterile and filled with air or mucus Symptoms are readily produced if infection occurs and the condition may then simulate widespread bronchiectasis or abscess formation, with cough, copious expectoration and dyspnea Rupture of cysts following exertion has been reported with the symptoms of a spontaneous pneumothorax⁷

The diagnosis of cystic disease depends mainly on x-ray and bronchography It should be kept in mind when infants develop progressive respiratory difficulty In later life the appearance of pulmonary insufficiency in patients without ascertainable cause

should suggest the condition Cystic disease must be differentiated from the following conditions spontaneous pneumothorax, emphysematous blebs with valvular bronchial obstruction, pleural blebs, abscess cavities, cystic bronchiectasis and thin walled cavities of other origin

Treatment depends on the type of cysts and the symptoms they produce Solitary balloon cysts require excision for there is danger that they may become infected or rupture Progressive dyspnea due to ballooning out of a cyst or rupture necessitates deflation by aspiration, with subsequent operation Small isolated cysts require no treatment unless infected In that case, removal is necessary only if postural drainage and bronchoscopy fail to effect a cure Lobectomy or pneumonectomy is indicated where extensive cystic change is present in one lung to obviate the danger of infection Bilateral advanced cases must be treated symptomatically, as in advanced bronchiectasis

The difficulty in differential diagnosis between spontaneous pneumothorax and lung cyst has been reported by other clinicians⁷⁻⁸ The following case is indicative of the problem with a successful result

REPORT OF CASE

A woman aged 35 was referred because of persistent dyspnea Past history was irrelevant No complaints were present until the summer of 1940 when shortness of breath was noticed Absent breath sounds were detected on the right by her physician when she consulted him during an attack of "grippe" in December 1940 A roentgenogram taken at that time (Fig 1), revealed what appeared to be a spontaneous pneumothorax on the right and she was placed on absolute bed rest for 3 months No re-expansion occurred and dyspnea became more marked

Examination fluoroscopically in April 1941 revealed a marked tension pneumothorax on the right, with the lung compressed to the base and the heart and mediastinum shifted to the left No fluid was present Adhesions at the costophrenic angle were suspected Intrapleural readings were 0,+4 The diagnosis of spontaneous pneumothorax with check-valve fistula was made and deflation begun Repeated removal of 2000-3000 cc of air every 2-3 days over a period of 2 months failed to produce sustained re-expansion of the lung On occasion difficulty was had in entering the apparently free pleural space and obtaining "good" readings The reason for this did not become apparent until later The last aspiration of 3750 cc of air on May 24, 1941 produced no re-expansion of the lung

A thoracoscopic examination was then advised to determine whether the suspected adhesions at the base might not be holding open a tear in the lung This was done by Dr George Willauer on May 31, 1941 No adhesions were found Those suspected on x-ray were really the base of a giant cyst which completely filled the pleural cavity and which was attached in many places to the lateral chest wall The lung was freely expanding though compressed to the base Numerous puncture wounds on the inner surface of the parietal pleura and the lateral cyst wall

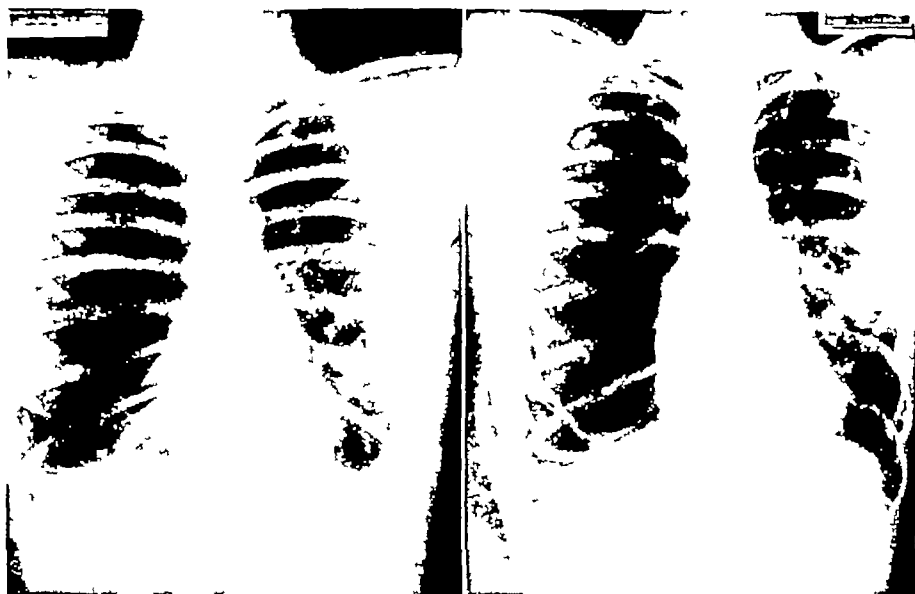


FIGURE 1

FIGURE 2

Fig 1 X-ray of December 1940, showing what appears to be a complete pneumothorax on the right with the lung compressed to the base. Adhesions are suspected in the costophrenic angle—*Fig 2* X-ray three days after exploratory thoracoscopy. The walls of the intrapleural cyst are now visible due to escape of air into the pleural space. Cyst is adherent to the lateral chest wall in the lower half of the pleural space.

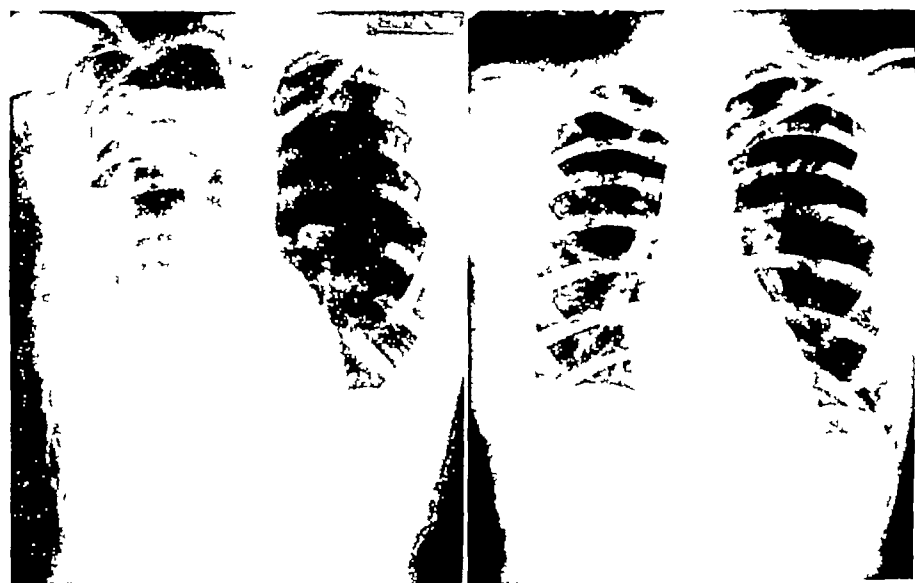


FIGURE 3

FIGURE 4

Fig 3 X-ray taken two weeks after cyst was removed, showing 80 per cent re-expansion of the lung—*Fig 4* X-ray ten months after removal of cyst, showing complete re-expansion of the lung and reabsorption of the fluid. Lung fields appear normal at this time.

were visible Figure 2 shows the x-ray appearance three days later, the walls of the cyst now being clearly defined due to the escape of air into the pleural space following introduction of the thoracoscope

Three weeks later the cyst was removed It was found to arise from the apex of the right upper lobe and to be attached diffusely in the pleural cavity A partial resection of the right upper lobe was done Effusion developed but was removed by frequent aspirations Figure 3 taken two weeks postoperatively shows 80 per cent re-expansion of the lung Complete re-expansion occurred by February 1942 (Fig 4), with complete absorption of the effusion Patient is now well and free from complaints

DISCUSSION

The presence of a cyst was not suspected, despite the failure of sustained attempts at re-expansion on deflation, since it was thought that this was due to a patent broncho-pleural fistula Repeated fluoroscopy and chest films did not reveal the commonly seen trabeculae which would have aroused our suspicion

Thoracoscopy readily explained the difficulty which was had at times with obtaining "good" intrapleural readings In those instances the needle was apparently inserted between the parietal pleura and the lateral cyst wall It was only when the needle entered the cyst itself that "satisfactory" readings were obtained

Examination of the resected lung revealed that the cyst was in direct communication with a bronchus and at the time of operation this communication was demonstrated by a probe The cyst wall consisted of fibrous tissue and was lined by a flattened layer of cells The recent development of dyspnea was probably due to the occurrence of a ball-valve obstruction in the bronchus connecting the cyst to the air passages, allowing air to enter more easily than it could leave it This was not demonstrated, however, on the removed specimen

The origin of this cyst was probably congenital in nature, arising in some malformation of the upper lobe and producing no symptoms until adult life

SUMMARY

- 1) A brief summary of the etiology, classification, clinical features and treatment of cystic disease of the lung is presented
- 2) The difficulty in differential diagnosis between spontaneous pneumothorax and lung cyst is illustrated by report of a case with successful surgical intervention

RESUMEN

- 1) Se presenta un breve resumen de la etiología, clasificación, rasgos clínicos y tratamiento de la enfermedad quística del pulmón
- 2) Se informa sobre un caso en el que se intervino quirúrgica-

mente con buen éxito, y que sirve de ejemplo sobre la dificultad en el diagnóstico diferencial entre el neumotórax espontáneo y el quiste del pulmón

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Legislative Implications of Adequate Tuberculosis Control*

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Tuberculosis, a Major Public Health Problem

"Tuberculosis is a community public health problem. It is as sound a public economy to provide the necessary medical and social services for its control and prevention as it is to spend public moneys for a safe water supply, proper sewage disposal, and fire and police protection.

"Tuberculosis is a chronic, relapsing disease and, since one case comes from another, the disease is essentially a slowly spreading epidemic. Tuberculosis is a costly disease, hospital care takes months and even years, and it is expensive. A negligible proportion of patients are financially able to meet the cost of hospitalization—accordingly the taxpayer is paying the bill whether he realized it or not."¹

The above statement is simply an introduction to the fact that large legislative appropriations are justified and, as will be shown later, are essential requirements for adequate tuberculosis control.

Tuberculosis Laws—Rules and Regulations

Texas laws are basic and, for the most part, can be applied to restrictive measures to prevent the spread of infection, but the laws we have are not enforced. For example, Physicians do not report active cases of tuberculosis that they see, and directors of local boards of health are reluctant to stir up opposition by enforcement of the law since they hold appointive positions. The directors of local boards of health fail to inspect quarters where death from tuberculosis have occurred, and enforce upon owners the sanitary renovations necessary before another family is allowed to move in—due to lack of adequate funds for employment of enough sanitary inspectors. Compulsory measures for the management of individual cases of tuberculosis are rarely required. Most people have an aversion to, and fear of, legal entanglements. Moral persuasion, and holding out to recalcitrant tuberculous persons the existing compulsory regulations, will often be sufficient to gain their cooperation. People cannot be legislated into being

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good but can be influenced by forceful, tactfully trained public health workers and leadership into cooperation and, only occasionally, will it be necessary to apply the basic compulsory laws we already have

Essentials of Tuberculosis Control

Surgeon General Parran, U S Public Health Service,² summarizes the essentials of tuberculosis control as follows

- 1 X-ray examination of the entire population
- 2 Follow-up of every case of tuberculosis discovered by x-ray
- 3 Periodic examinations, including x-ray examination, of persons with inactive disease
- 4 Prompt treatment for patients with active disease
- 5 Strict isolation of open cases to prevent further spread of the disease
- 6 Intensified health education activities among the general population, patients, and their families
- 7 Expanded research in tuberculosis and control measures
- 8 Financial aid to the bread winner and his family

To carry out a program of such magnitude, it is evident, that an official agency is necessary and, for this phase of the organization, Parran outlines a pattern with the following comment

"In the National Program, the accepted pattern of Federal assistance to the States would be applied under specific authorization of funds by the Congress State Health Authorities, in turn, would take the leadership in the *establishment and support* of tuberculosis control programs in local *health departments* Local health agencies, official and voluntary, would coordinate all available community resources, working closely with the medical profession and welfare groups whose help will be needed to the fullest "

With the above pattern in mind, it is evident that the foundation and superstructure of a Texas State-wide tuberculosis control program should be under the direction of the Tuberculosis Control Division of the Texas Department of Health

Comparing the Above Program with a Tuberculosis Control Program Proposed by the Board of Directors, Texas Tuberculosis Society

We find conflict of authority interfering with a unified program and a division of responsibility The six objectives outlined are right in principle, but wrong as to application

There is revealed a division of responsibility in that the Texas State Department of Health is to take over a part of the control program, that the State Board of Control is to take over the medical policies of hospitalization of tuberculosis cases, and, that the Tuberculosis Committee of the Texas Medical Association shall

offer both departments an Advisory Committee Wrong! Advisory committees, unsolicited, are usually resented, and are of little value County and State sanatoria are just as much a part of a tuberculosis control program as is the establishment of other phases of the control program Either the whole program should be handled by the Board of Control or legislation authorizing the establishment of a Tuberculosis Control Board, composed of a Directorate of Tuberculosis Specialists (three in number), nominated by the Tuberculosis Committee of the State Medical Association of Texas, and two lay members of the Texas Tuberculosis Society, thereby forming a directorate (not simply advisory) with authority to act and, under whom, the Director of the Division of Tuberculosis Control will carry out the details of establishing clinics, employing field nurses, and all other machinery of an efficient program authorized by the Directorate The Superintendents of State Sanatoria would run their individual institutions in cooperation and in accordance with the Directorate of the Texas Division of Tuberculosis Control The financial accounting should be set up either through the Texas Board of Control or a state auditor Upon this point I am not competent to pass Legislation eliminating the above division of authority and obviating conflict is essential to a unified, well-coordinated program We talk blithely of a campaign to control tuberculosis and applaud and endorse "The Essentials of a Tuberculosis Control Program," as outlined by Parran, and our Legislature would probably agree to such a program in theory, but when it comes to the appropriation of funds to carry out such a program, they would want to know the approximate cost

A Yardstick of Measure is Submitted

In December of 1945, while in Washington, New York, and New Jersey, I obtained the following information

A representative of the U S Public Health Service stated that the data they had obtained on the latest, up-to-date, modern hospital construction indicated that the cost of construction of hospitals would be from \$6,000 to \$7,000 per bed (fully equipped), and the cost of maintenance from \$6 00 to \$7 00 per day per patient, with a full complement of personnel

A visit to one of the New York up-state district hospitals at Onconto brought out the fact that the Homer T Folks District State Hospital cost (ten years ago) approximately \$5,500 per bed, and the present cost of maintenance was approximately \$6 00 per day, which cost included complete staff and personnel The construction of this hospital was excellent, consisting of single rooms, two-bed wards, and four-bed wards Surgical collapse therapy was

done by a rotating team going from one district state hospital to another. Designated members of the staff made diagnostic itineraries to county health units of the counties of the district at stated intervals, taking with them a portable x-ray unit, and held clinics and conferences previously arranged by the field nurse.

I also visited a modern county sanatorium at Broad Acres, Utica, New York. The construction cost of which was around \$5,000 per bed, fully equipped, and the maintenance cost of between \$5.00 to \$5.50 per day per patient. In the State District Sanatorium, one-half of the per-diem cost was charged to the county from which the patient came, and in the county sanatorium, the State paid one-half of the per diem cost of each patient.

In the State of New Jersey, the same rule applies as to sharing the per-diem cost per patient. Hudson County Tuberculosis Sanatorium, a unit of the Medical Center of Jersey City, is a magnificent institution. This institution, completely equipped with private rooms, two-bed rooms, and no ward of more than six beds, cost between \$6,000 and \$7,000 per bed, and maintenance for same is between \$6.00 and \$7.00 per day per patient.

Cost of hospital construction today is approximately \$6,000 per bed.

When we consider that private hospitals charge from \$5.00 to \$7.00 per day, exclusive of laboratory and x-ray work, and utilize special nurses—charged to the patients—it is reasonable to assume that \$6.00 per day per patient for efficient and adequate service is a reasonable cost with the present-day inflation.

Applying the above Yardstick of Measure

4,000 additional beds at \$6.00 per bed	-- -- -- --	\$24,000,000
4,000 additional beds' maintenance at \$6.00 per diem	--	8,000,000

Financial aid to bread winner

This is figured upon the basis that 1 in 10 would so qualify or 400 at \$60.00 per month. (The above fund would best be handled through local welfare agencies rather than through the family to be expended foolishly)

To the Texas State Department of Health		
Tuberculosis Division—annually	-- -- -- --	620,510

The \$24,000,000 cost of construction can probably be reduced by Federal aid to \$16,000,000. The \$16,000,000 can further be reduced by cities and counties who have already voted bond issues. There will also be a further saving in the event Fort Ringgold is utilized.

as a District State Sanatorium, nevertheless, a sizable sum will be required for construction to make 4,000 additional beds available

The \$8,000,000 maintenance cost to the State can be reduced one-half if the state and counties share alike the per diem cost of patients hospitalized in state and county hospitals

The above figures may sound grandiose but to win against the enemy our Armed Forces demanded the best equipment, a full complement of trained personnel, unlimited financial support, and, until such was available, fought defensive battles, but as soon as the above requisites were available, a vigorous aggressive campaign resulted in shortening the time for subduing the enemy, thus saving many lives and money in the end—the same will be true in the fight against tuberculosis

Supplying 4,000 additional beds is not the only essential of adequate tuberculosis control, but the establishment of pneumothorax and diagnostic clinics in thirteen areas, the employment of clinic and tuberculosis field nurses, part-time and full-time tuberculosis specialists, clerical assistants for tuberculosis registry, purchasing or aiding in the purchase of fluoroscopic equipment, purchasing or aiding in the purchase of x-ray equipment, along with the employment of sufficient personnel is no small order and, as estimated by me, would be approximately \$620,510 the first year. However, from my observation and experience, such a program of early diagnosis, pneumothorax treatment, supervision of cases returned from the sanatoria, and follow-up of all cases showing significant findings is so important that, in the beginning, new hospital construction should be on the basis of one bed to each death and so constructed that additional units may be added as needed, i e, that 2,000 additional beds be built in localities where the death rate is high, and no units of less than 100 to 150 beds be constructed, that the diagnostic and pneumothorax clinics be instituted without delay with an approximate expenditure through the Tuberculosis Division of the State Department of Health of \$620,510

The item of financial aid to the bread winner and his family, while he is incapacitated, is so obviously an essential as to need no discussion unless it be the minimum or maximum amount per month

Since 1917, there has been a decrease of 68 per cent in the human death rate from respiratory tuberculosis and 84 per cent in other forms due, to a considerable extent, to the elimination of the disease in cattle "

Stewart,⁴ in an article "Tuberculosis Control," made the following comment

"It is helpful to recall that in spite of violent opposition, approximately 8,000 veterinarians applied tuberculin tests to 25,000,000 cattle in 1925, and applied nearly 250,000,000 tests between 1917 and 1942, inclusive. The reduction of bovine tuberculosis to the vanishing point, accomplished by a relatively small group of veterinarians in the course of 25 years, challenges 150,000 licensed physicians in the United States to eradicate human tuberculosis."

*Adequate Appropriations for Tuberculosis
Control is Sound Economy*

The National Tuberculosis Association estimates that every death from tuberculosis represents an economic loss (in treatment and loss of employment) of \$10,000. By the same token, the economic loss from the 2,923 deaths in Texas in 1945 was \$29,230,000.

From Canada, Richards⁵ reports "Ontario has a very active, efficient prevention department which has calculated that it costs approximately \$500 to find each case of tuberculosis, about \$1,000 to treat each minimal case of tuberculosis, \$3,000 for each moderately advanced case, and \$5,000 for each far advanced case."

Dublin,⁶ at an annual meeting of the American Public Health Association, made this statement:

"It is estimated that in two years, 1937-1939, when Detroit City Council was backing the Health Department with \$400,000 in the tuberculosis case-finding program, more than \$1,300,000 was saved to the City of Detroit in hospital bills by discovering and treating cases in the early stages of the disease and through the prevention, by this means, of additional cases."

These facts should be brought to the attention of the voters of Texas and the legislators by well organized groups throughout the state. In the recent race for governor, one candidate brought out the fact that only eight cents per capita was spent annually for the public health, stating, "that is a disgrace," which it is. In the Framingham Demonstration, a summary of which is submitted, the following statement in conclusion was made:

"The most significant result of this attempt to control tuberculosis was the way in which community sentiment was aroused, so that the total cost of health work from all agencies increased from 40 cents to \$2.40 per capita. These figures indicate that lack of funds can be overcome provided proper leadership and education is available."

Whether legislative appropriation of funds by direct taxation on real estate or by sales tax should be made, is open to debate and decision, but the fact that the American people can afford to pay for tuberculosis control is illustrated by the fact that in 1940, the people of the United States spent ⁷

\$ 56,721,746 for chewing gum
\$134,525,233 for cigarettes
\$282,002,617 for ice cream

M Scarborough, County Judge of El Paso County, made the following comment

"We have a county hospital that we are unable to maintain to full capacity—and I am of the opinion that regional hospitals established by the State and either maintained by the State or partially maintained by the State with the balance furnished by counties is the solution of Tuberculosis Control It occurs to me that the most equitable way in which to obtain the money would be either from a gasoline tax or a tax on gas and oil and gas at its source, that is, a production tax It is my understanding that approximately 80 per cent of the gas and oil is paid for by citizens outside of the State of Texas, yet our National resources are being depleted, by having these resources leave the State of Texas A tax such as this would give a definite sum per year upon which to rely and you would not be subject to the whim of the Legislature each year It is my opinion, however, when you go before the Legislature with a Tuberculosis Control Program, you should have some concrete suggestion, as to where the money might come from, otherwise, you would have just as strong a fight against the sources of the appropriation as you would the appropriation itself regardless of the source "

To educate the voters and public officials of the State to the need of adequate tuberculosis control, leadership will be required, comparable to Community Chest Drives or Government Bond Sales, to organize workers and clubs in every county of the State

It would also be wise to employ a Commission, composed of an architect with experience in construction of tuberculosis hospitals, an officer of the U S Public Health Service, a tuberculosis specialist with experience in the administration of State District hospitals, and a tuberculosis specialist with experience in tuberculosis control where county hospitals are used Such expert advice is of material value in planning Their recommendations would lend support for legislative requests for specific appropriations

Demonstration of Tuberculosis Control

A demonstration that was made as an experiment in 1917 by the Metropolitan Life Insurance Company was as follows

This company offered to the National Tuberculosis Association the sum of \$100,000 for the purpose of demonstrating, if possible, the control of tuberculosis in a typical American community by applying the knowledge of medicine and methods of tuberculosis

control After some research, Framingham, Massachusetts, a town of approximately 17,000 population was selected for this purpose The original appropriation was practically doubled in the course of the demonstration which covered a period of seven years—beginning in 1917

The reports of this demonstration are set forth in a series of ten monographs, the last of which—number ten—gives the final summary report This demonstration was under the direction of Dr Donald B Armstrong

A preliminary survey of a sickness census, taken through a home canvass, disclosed a rate of 1·8 per cent for incapacitating sickness, 6·2 per cent for total illness, and 2·4 per cent for tuberculosis in a home canvass of 6,582 people of the town

The establishment of a diagnostic and consultation service for physicians had two marked effects in case findings, namely, an actual increase in the number of cases, and a marked increase in the percentage of incipient tuberculosis discovered Eventually, the ratio of active cases to annual deaths from tuberculosis was found to be nine to one In other words, wherever there is one death caused from tuberculosis, one may expect to find approximately nine active cases of tuberculosis It was also found that one per cent of the population of this typical town had active tuberculosis and, also, one per cent of the population were arrested cases of tuberculosis It was also found that the percentage of the cases discovered in the early stages increased from fifty-five per cent to eighty-eight per cent, while the cases reported before death increased from 60 to 93 per cent The percentage of cases treated in institutions increased from 15 to over 50 per cent The experience of the demonstration indicated that from one to two institutional beds were necessary for every annual death of tuberculosis

The most significant result of this attempt at tuberculosis control was the way in which community sentiment was aroused so that this small town was willing to pay for tuberculosis control The cost of health work in the community for all private agencies increased during the seven years from \$900 to \$17,000 per year The total cost of health work in the community for all agencies increased from \$0·40 per capita per year to \$2·40 per capita per year These figures indicate that lack of funds can be overcome, provided proper leadership and education is available

As an example of what can be done in the control and ultimate eradication of human tuberculosis, we may well profit by the example set and experience obtained by the Live Stock Industry in obtaining legislation

H R Smith, General Manager, National Live Stock Loss Prevention Board, stated in an article in 1944

"On March 4, 1917, the Congress appropriated \$75,000 for tuberculosis eradication, but no provision was made for indemnity on reacting cattle slaughtered "

"In 1917 we supplied information to Congressman C H Sloan of Nebraska, author of a bill providing an appropriation of \$1,000,000 for tuberculosis eradication At the first hearing before the House Agricultural Committee, January 14, 1918, the writer stated that progress could not be made without partial reimbursement on reacting cattle slaughtered, so large a number of cattle were then infected, many breeders would otherwise be put out of business It was pointed out that this was also a public health measure and every taxpayer should be willing to help A clause was inserted to provide that the Federal Government would pay one-third of the loss to a limit of \$25 00 on grades and \$50 00 on pure-breds, provided the state or county would pay at least an equal amount Soon after, numerous state legislative hearings were held and appropriations made out to meet the conditions of the Federal Laws "

"The House of Representatives voted \$250,000, the amount recommended by the U S Department of Agriculture Resolutions adopted by a number of livestock organizations, urging a larger appropriation, were sent and the Senate increased this to \$500,000 for indemnity and operating expense, which, after a public hearing attended by livestock men from the various states, was later approved by the House "

"Each year, thereafter, hearings were held in Washington attended by representatives of producer organizations, market groups, State Departments of Agriculture and medical associations Charts were prepared to show the progress in cattle testing under the able direction of the U S Bureau of Animal Industry and the state departments, with the resultant decrease in losses These annual hearings were continued until 1928 when Congress appropriated \$6,000,000 By 1932 this was increased to \$6,505,800 The state and county appropriations totaled approximately \$13,000,000 for that year By 1935, the Federal, State, and County appropriations totaled \$26,792,179—the maximum amount for any year with substantial decreases since, according to needs, until now a relatively small sum is required "

SUMMARY

1) The essentials and a pattern of tuberculosis control has been discussed

2) Legislation for the correction of division of authority and conflicts that may arise is advised

3) The present-day cost of construction and maintenance of 4,000 additional beds has been estimated

4) The question as to whether the State and counties shall share, and share alike, is open for future decision, but that the State share half of the per-diem cost per patient is definitely advised where acceptable county and city tuberculosis hospitals exist, and until such time as District State Hospitals are built

5) In carrying out one of the essentials of adequate tuberculosis control, to wit X-raying of the entire population, employment of personnel, such as part-time or full time tuberculosis specialists and field nurses, and the establishment of tuberculosis pneumothorax and diagnostic clinics, well over \$500,000 should be appropriated annually to the State Department of Health, earmarked for the Division of Tuberculosis—this is necessary

6) Legislation for large appropriations of money is indicated and can be justified from an economic standpoint by the data and figures submitted

7) An educational program for the purpose of better tuberculosis control is advocated and the appointment of a Commission composed of an architect and three medical experts in tuberculosis control to study and report their findings, is recommended

RESUMEN

1) Se han discutido los rasgos esenciales y el patrón para el control de la tuberculosis

2) Se recomienda que se expidan leyes para la corrección de la división de autoridad y de los conflictos que puedan ocurrir

3) Se ha calculado el costo anual de la construcción y el mantenimiento de 4,000 camas adicionales

4) La cuestión de si el Estado y los Condados deban contribuir, y contribuir igualmente, ha de ser decidida en el futuro, pero se recomienda definitivamente que el Estado contribuya con la mitad del costo diario por paciente donde existan hospitales aceptables en el condado y en el municipio y hasta tanto se construyan Hospitales Distritoriales del Estado

5) Para llevar a cabo uno de los puntos esenciales del control adecuado de la tuberculosis, a saber, exámenes radiográficos de la población entera, empleo de personal, tal como especialistas de tuberculosis y enfermeras de campo, empleados parte del tiempo o de tiempo completo, y el establecimiento de clínicas para el diagnóstico de la tuberculosis y la administración de neumotórax, debe asignarse anualmente al Departamento de Sanidad del Es-

tado una partida de mucho más de \$500,000, destinada para la División de Tuberculosis. Esto es necesario.

6) Es necesario que se expidan leyes que adjudiquen grandes sumas de dinero, lo que se justifica desde el punto de vista económico por los datos y cifras presentados.

7) Se aboga por un programa educativo con el fin de lograr un mejor control de la tuberculosis, y se recomienda el nombramiento de una Comisión compuesta de un arquitecto y de tres médicos expertos en el control de la tuberculosis para que conduzcan un estudio y presenten sus hallazgos.

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Necropsy Incidence of Tuberculosis in a Hospital for the Mentally Ill*

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The high incidence of tuberculosis in mental institutions has received wide attention in the literature of recent years. A number of authors have pointed out that deaths due to tuberculosis are far more numerous in patients in mental institutions than they are in the general population. Kupka¹ stated that about 5 per cent of all tuberculosis deaths occur in mental institutions. Deegan and his co-workers² reported that for a three year period (1937-1939) the death rate for tuberculosis in mental hospitals in the state of New York was 12 times the tuberculosis death rate of the general population of the state.

Most of these estimates are based on clinical diagnoses, and statistical reports on the incidence of tuberculosis in mental hospitals based on autopsy records have not been adequate or conclusive. It is felt that such data are necessary for a complete understanding of the problem of tuberculosis in mental hospitals, so that proper measures may be adopted for the prevention of spread of the disease to both patients and employees.

The present report is based on a series of 634 consecutive autopsies performed at the Pittsburgh City Home and Hospitals, Mayview, Pennsylvania, over a five year period from 1937 to 1941 inclusive. This series is unusual in that it includes both general hospital and mental patients, and it affords an opportunity for some comparison of the two groups. The general hospital statistics at this institution cannot be compared to the average general hospital records, however, as most of the general hospital patients admitted were suffering from long standing, chronic, medical conditions. Only a few surgical patients are included in the group.

The institution had a small tuberculosis hospital in a separate building with facilities for both general and mental hospital patients, so that patients with a clinical diagnosis of tuberculosis were transferred to this department and the records of the deaths in this group are included in our statistics.

For the purpose of this report, healed tuberculosis was not included in our study. We included active tuberculosis anywhere in the body, although we were primarily interested in active tuber-

*From the Department of Pathology, Pittsburgh City Home and Hospitals, Mayview, Pennsylvania, and the Department of Pathology, Memorial Hospital, Danville, Virginia.

culosis of the lungs from the standpoint of determining the amount of exposure to which other persons might have been subjected. The term tuberculosis in this report is used only to indicate active tuberculosis.

The incidence of tuberculosis was high in both mental and non-mental groups. Active tuberculosis was found in 52 of 245 necropsies on mental patients, an incidence of 21.2 per cent, and in 59 of 389 necropsies on general hospital patients, an incidence of 15.1 per cent. The high incidence of tuberculosis in general hospital patients is at least partially explained by the high percentage of chronic medical cases admitted to the hospital and by the fact that when tuberculosis was diagnosed the patients were kept in the institution. Even so, the frequency of tuberculosis in mental patients was 40.3 per cent higher than in general hospital patients.

This study confirms the frequently reported observation that tuberculosis is not exclusively a disease of young people. The average age of mental patients with tuberculosis was 51.9 years, while the average age of the general hospital patients with tuberculosis was 58.4 years. The average age at autopsy of the entire group was 60.04 years.

The incidence of tuberculosis according to sex did not appear significant. There were 472 males in the series with a tuberculosis incidence of 18.2 per cent and 162 females with a tuberculosis incidence of 15.4 per cent.

In view of the danger of spread of infection, particularly in the mental group, we were interested in the degree of accuracy of the clinical diagnoses in these cases. In the mental group 28 out of 52 (53.8 per cent) were diagnosed before death, and in the general hospital group 33 out of 59 (55.9 per cent) were diagnosed before death. In connection with the danger to other mental patients, we discovered that 11 of the mental patients with a correct diagnosis of tuberculosis before death were diagnosed only within a month of the date of their death. In other words, the condition was discovered only in the terminal stages, and the exposure to other patients was almost as great as if the clinical diagnosis had not been made. The percentage of correct diagnoses in the general hospital group might have been higher except that some of the general hospital patients were admitted to the hospital in a dying condition, so that in certain instances the time interval before death did not allow for proper evaluation of the case.

Tuberculosis was not the primary cause of death in all the 111 patients with active tuberculous lesions. We arbitrarily divided the group into three main divisions. In the first, tuberculosis was the primary cause of death, in the second, tuberculosis was regarded as contributory to the death, while in the third group,

tuberculosis did not contribute to the death. Among the mental patients 39 died of tuberculosis, a death rate for the group of 15.9 per cent. Of the general hospital patients 41 died of tuberculosis, a death rate of 10.5 per cent for this group. These figures are shown in Table 1.

TABLE 1
Classification of Tuberculosis in Relation to Cause of Death

Patients	Primary		Contributory		Non-Contributory	
	No	Per cent	No	Per cent	No	Per cent
Mental	39	15.9	4	1.6	9	3.6
General	41	10.5	7	1.7	11	2.8
TOTAL	80		11		20	

The tuberculous patients were also divided into three groups in relation to the presence or activity of tuberculosis in the lungs. The first group included those patients with active tuberculosis in the lungs, the second included those with healed tuberculosis in the lungs and active tuberculosis elsewhere, and the third group was made up of those patients showing no tuberculosis in the lungs but active tuberculosis elsewhere. These figures are shown in Table 2. Of those listed as showing active tuberculosis of the

TABLE 2
Classification of Lesions

Patients	Active in Lungs		Obsolete in Lungs	Not in Lungs
	No	Per cent	Active elsewhere	Active elsewhere
Mental	52	21.2	0	0
General	53	13.6	3	3

lungs, five showed only minimal changes, while the others showed moderate to far advanced tuberculous involvement.

We have not attempted to present the figures on the incidence of active tuberculosis in locations outside the lungs. However, we considered the possibility that tuberculous enterocolitis might be more frequent in mental patients due either to voluntary swallowing of sputum or to involuntary swallowing of sputum due to interference with reflexes. In the group with tuberculosis of the lungs 37 or 35.2 per cent of the patients showed tuberculous enterocolitis, but there was no significant difference in incidence between mental and nonmental groups. Among the mental patients 19 or 36.5 per cent showed tuberculous enterocolitis, while 18 or 33.9 per cent of general hospital patients showed similar involvement.

SUMMARY

1) Active tuberculosis was found in a high percentage of mental and general hospital deaths in a series of 634 consecutive necropsies in a large city institution. Active tuberculosis was noted in 52 of 245 necropsies on mental patients and in 59 of 389 necropsies on general hospital patients.

2) The percentage of these patients with a clinical diagnosis of tuberculosis was not high. Among the mental group only 28 out of 52 were diagnosed before death and 11 of these 28 were diagnosed only within the month prior to death.

3) Statistics on the incidence of tuberculosis as the primary cause of death in these patients are presented. Tuberculosis was found to be the primary cause of death in 15.9 per cent of the mental patients and 10.5 per cent of the general hospital patients. These necropsy statistics substantiate current reports in the literature concerning the high death rate from tuberculosis in mental institutions. The study emphasizes the need for continued effort to attain proper diagnostic and preventive measures in such institutions.

RESUMEN

1) Se descubrió tuberculosis activa en un elevado porcentaje de defunciones entre los pacientes mentales y de hospital general en una serie de 634 autopsias consecutivas en una grande institución municipal. Se encontró tuberculosis activa en 52 de 245 autopsias en pacientes mentales fallecidos y en 59 de 389 autopsias en pacientes de hospital general.

2) No fue alto el porcentaje de estos pacientes en los que se había hecho un diagnóstico clínico de tuberculosis. Entre el grupo de enfermos mentales solamente 28 de los 52 fueron diagnosticados antes de morir y 11 de estos 28 sólo fueron diagnosticados durante el mes anterior a su muerte.

3) Se presentan datos estadísticos sobre la frecuencia de la tuberculosis como causa principal de muerte en estos pacientes. Se encontró que la tuberculosis fue la causa principal de muerte en el 15.9 por ciento de los enfermos mentales y del 10.5 por ciento de los pacientes de hospital general. Estas estadísticas autópsicas verifican los corrientes informes en la literatura acerca de la elevada mortalidad por tuberculosis en instituciones de enfermedades mentales. El estudio recalca la necesidad de continuar esforzándose por alcanzar apropiadas medidas diagnósticas y profilácticas en esas instituciones.

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EDITORIALS

Necropsy Diagnoses

In this issue of *Diseases of the Chest*, Moran reports that among 245 necropsies of persons who died in an institution for the mentally ill, 52 (21.2 per cent) had active tuberculosis, while among 389 who died in a general hospital 59 (15.1 per cent) had active disease. In the institution for the mentally ill only 28 (53.8 per cent) of the 52 and in the general hospital group, 33 (55.9 per cent) of the 59 cases were diagnosed before death. The average age of the entire 111 patients at the time of autopsy was 60.04 years. This is not surprising because the age at which clinical tuberculosis causes illness and death has shifted upward during the past three decades.

In an analysis of 14,719 necropsies in private and general hospitals in New York City and vicinity, Medlar compared those which were done from 1916 to 1920, with those between 1940 and 1945. Pathologically significant tuberculosis was less frequently found in those under 10 years of age in the 1940-1945 group. Thus, the autopsy findings would indicate that the measures used to protect infants and children in New York have been effective. This is also borne out in a striking way in mortality rates. For example, in 1915 among children under 15 years, 1200 died from tuberculosis, whereas, in 1940 only 110. The population in this age period has remained fairly constant at 1,500,000. Moreover, the infection attack rate among children has markedly decreased. Obviously, where there is no primary tuberculosis there can be no endogenous reinfections resulting in illness and death. Children have been so well protected that a relatively small number now have primary tuberculosis, and a correspondingly low incidence of pathologically significant lesions are seen at necropsy. This situation can be observed wherever children have been protected against tuberculosis. The longer these protective measures have been in existence, the farther into life's span this low incidence of tuberculosis extends. In the Midwest and West of the United States there are areas where less than 10 per cent of those of 19 years react to tuberculin. Thus, more than 90 per cent have escaped primary lesions and, obviously, the incidence of pathologically significant tuberculosis found at necropsy in this age period is extremely low.

Between 10 and 50 years there was no essential difference, but among persons who died after the age of 50 years, Medlar found more pathologically significant tuberculosis in those examined from 1940 to 1945 than in those from 1916 to 1920. This is not surprising for two reasons. (1) There is probably as much residual tuberculosis among humans in this age group now as among those of the same age from 1916 to 1920. Probably both groups had approximately the same exposure in childhood and young adulthood. Certainly those now over 50 years were afforded little protection against the human and the bovine types of tubercle bacilli as infants or children. Therefore, the majority of them probably developed primary lesions, and in some there still reside the descendants of the tubercle bacilli which initially infected them. (2) The lives of many more persons extend into the period beyond 50 years than was true from 1916 to 1920, and thus more tuberculous lesions

have time to mature. Therefore, one would expect to find more clinically and pathologically significant tuberculosis among the old people of today than among those of a quarter of a century ago. Moran and Medlar emphasize the great importance of adequate examination of all persons beyond the age of 50 years as the proper disposition of those with contagious disease is an essential part of the tuberculosis control program of any community.

Much could be contributed to our knowledge of tuberculosis by more thoroughgoing pathological studies such as those by Moran and Medlar. The pathologist is the last court of appeal in diagnosis, since he has opportunities afforded no one else in the field. There is nothing known from naked eye inspection through bacteriological determinations, microscopic studies and the most delicate chemical tests that he cannot use in a direct manner. The superiority of his diagnostic armamentarium places upon the pathologist a responsibility shared by no other person in the field of diagnosis. Unless he uses every facility at his command his diagnoses can be just as erroneous as those made antemortem by physicians and surgeons. Errors by pathologists may be more serious than those of others from the standpoint of vital statistics, contagion, litigation, etc., because their diagnoses are regarded as final.

The pathologist also has the unique opportunity of locating previously unsuspected conditions and diagnosing them accurately. This is particularly true of a vicissitudinous disease like tuberculosis whose lesions may alternately be active, quiescent or arrested temporarily or permanently. They may be so small as to cause no pressure symptoms or toxemia. Again, if in the lungs they may attain extensive proportions without causing pain, since these organs are devoid of sensory pain nerve fibers. They may cause no shortness of breath because of the large reserve capacity of the lungs. Therefore these lesions often are not diagnosed or even suspected until the pathologist finds them. Wherever tuberculous infection is universal one expects the pathologist to find tuberculous lesions in the bodies of all adults dead from any cause. These lesions vary from the size of a pinhead to massive excavated processes.

The physician has only two methods of procuring accurate information regarding the incidence of tuberculosis in any group of people, namely, the tuberculin reaction and the postmortem examination. The tuberculin reaction, properly administered, should coincide with postmortem findings. This is as true in man as in domestic or experimental animals. No phase of the examination except the tuberculin test is delicate enough to reveal anything more than gross pathology in the living body. If careful antemortem examinations are made including x-ray film inspection of the chest, but the tuberculin test is omitted there will be many surprises at the postmortem table. In fact, a great deal of tuberculosis can exist in tuberculin reactors which is not located by any phase of the examination during life but is clearly in evidence at postmortem.

The student of tuberculosis today recognizes the absurdity of attempts to make accurate diagnoses of tuberculosis from x-ray shadows alone. He is also aware of the fact that pathologists' diagnoses without adequate investigation can be just as erroneous as those made from x-ray shadows. A famous pathologist was asked what percentage of the calcium deposits found at necropsy in the pulmonary parenchyma and

hilum regions are due to tuberculosis His answer was 99.5 per cent Obviously he had never taken the time to determine the etiological agents producing lesions in which calcium is deposited If he had, in all probability he would have discovered that more than half of the depositions of calcium which he assumed resulted from tuberculosis were actually due to other conditions, with a preponderance of fungus infections, because he worked in an area where histoplasmosis was later found to be endemic

Long ago pathologists had the opportunity to discover that coccidioidomycosis frequently has calcium deposit in its lesions, but they did not take time to make sufficiently detailed examinations and thus went on believing and teaching that tuberculosis is responsible for most of the calcium deposits in the lungs Inaccuracies in pathological diagnoses also extended to other types of pulmonary lesions, even those that had cavitated and were extensive

Today the student of tuberculosis does not give serious consideration to a pathological diagnosis unless bacteriological evidence has been obtained, not just by finding acid-fast bacilli and giant cells in smears and sections, but by culture and, still better, by animal inoculation He does not accept the diagnosis of any other disease caused by microorganisms unless they are actually recovered from materials obtained at postmortem examination He does not accept the diagnosis of silicosis unless chemical analysis reveals the presence of free silica in sufficient quantity to produce this disease In this era, when specific evidence is demanded before the pathologist's diagnosis is acceptable, one wonders about the accuracy of many diagnoses in the past, resulting in such broad and sweeping statements concerning so called epidemics of acute tuberculosis

J A M

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Carlo Forlanini — 1847-1918

In commemoration of the 100th anniversary of his birth

One hundred years have gone by since the birth of Carlo Forlanini, the originator of the systematic use of artificial pneumothorax as an independent therapeutic measure for the treatment of pulmonary tuberculosis Born in Italy, he completed his medical studies at the age of 23 Then he joined the staff of the Ospedale Maggiore of Milan His clinical ability was given due recognition by his promotion to the position of chief of the medical, pediatric, obstetrical and dermatologic services at this hospital In 1884, at the age of 37, he began his teaching activities in physical diagnosis at the University of Turin and continued at the University of Pavia in 1899 At the latter institution, he became Professor of Clinical Medicine in 1900 During his entire professional career, he devoted a great deal of time and effort to the study of tuberculosis and contributed extensively to the medical literature on this subject The year of 1882 is a memorable one in the history of Medicine on account of the discovery of the tubercle bacillus by Koch and because of the publication of Forlanini's epoch-making treatise on the rationale of

artificial pneumothorax The latter was printed in the *Gazetta degli Ospedali & delle Cliniche di Milano*, Volume 3, No 68, Page 537, August 23 and in subsequent issues of the same magazine during the same year His reasoning was based on the observations of other clinicians as well as of his own, noticing that spontaneous pneumothorax, with or without pleural effusion, had a favorable effect on the course of pulmonary tuberculosis He remarked "Surgeons have either let air enter the pleura, or have injected it for therapeutic purposes, both with no harmful consequences, if a pneumothorax arrests as such, the course of phthisis in a lung, if hydrothorax or pyothorax have formed by way of pulmonary paths, why should we not cause in a consumptive an artificial pneumothorax through the chest wall with the necessary precautions (easy to obtain) that will be useful in preventing secondary pleuritic processes?"

As to the technique of artificial pneumothorax, he pointed out that "it is necessary that the volume of air and its pressure be such as not to displace the mediastinum, and—whether the pulmonary opening stay open or be closed,—that inspiration would not bring the pressure down to a level insufficient to balance the pulmonary elasticity, 5-7 mm of mercury in normal conditions, and certainly a little more when the lung is consumptive If the pressure of the pleural air goes above this level, the patient becomes dyspneic, suffers from it and may eventually die rapidly by suffocation, if, instead it goes below the level, the lung participates in the respiratory motions of the thoracic box and so the mechanical reason for the beneficial action of pneumothorax is missed or lost"

The basic idea of his concept was that artificial pneumothorax was useful in tuberculosis because it immobilized the lung It is true that the thought of compressing the lung during intrapleural pneumothorax treatment has been entirely abandoned But artificial pneumothorax still enjoys an unprecedented preference by physicians engaged in the treatment of pulmonary tuberculosis Appropriately, today the so-called low-tension or hypotensive pneumothorax is the method of choice This procedure entails all the possible advantages without the risks of other types of pneumothorax The healing which results from the use of artificial pneumothorax is predicated upon relaxation of the lung This organ is richly supplied with elastic fibers This implies an innate pulmonary elasticity which causes the lung to recoil toward the hilum during each expiration and also, when the lung is free of the influence of the normal intrapleural negative pressure In this sense, the pneumothorax lung is a relaxed organ as compared with its stretched-out condition under physiologic circumstances Maybe this is an opportune moment to advance a plea for changing the terminology pertaining to artificial pneumothorax and other conservative methods which aim at a similar mechanical change in the diseased lung It is proposed to discard the term collapse therapy In its connotation, collapse carries the meaning of abrupt shrinking or falling together, with utter failure and uselessness It is agreed that such changes in the treated lung do not come under the intended purpose of artificial pneumothorax As a matter of fact, an adequate pneumothorax calls for a gradual and moderate reduction in the size of the lung In the true sense of the word, this is a state of relaxation and not collapse Thus, it appears that relaxation therapy is a more expressive term for portraying the effect of an ideal pneumothorax on the lung

The working mechanics of artificial pneumothorax readily explain its potential therapeutic benefits. The intrapleural negative pressure is the expression of the difference between the retractile elasticity of the lung and the traction exerted upon it by the thoracic cage (including the diaphragm) through the cohesion of the visceral and parietal pleurae. The thoracic cage is larger than the lung under physiologic circumstances. The interaction of the centripetal force of pulmonary contractility and the centrifugal force represented by the thoracic cage results in a force which exerts a suction effect upon the lung. It is interesting to recall in this connection that while the atmospheric pressure at sea level is 760 mm of mercury, the average intrapleural pressure is only 5.1 mm of mercury less than this on inspiration, and only 1.4 mm less on expiration. This apparently insignificant difference represents the suction force which holds the lung in apposition to the inner surface of the thorax. As soon as the suction effect of the intrapleural negative pressure is rendered less negative by artificial pneumothorax, the force of elastic recoil of the lung comes into play.

The following factors are considered the most important in the healing of a tuberculous lesion under pneumothorax treatment: (1) mechanical closure of cavities, (2) lessening of bronchogenous, lymphogenous and hematogenous spread of the disease, (3) decrease in the absorption of toxic materials from the involved area, (4) fibrosis due to lymph stasis, (5) fibrosis due to relative tissue anoxia, (6) inhibition of the propagation of tubercle bacilli resulting from local tissue anoxia, (7) impairment of the viability of the tubercle bacilli in consequence of accumulation of carbon dioxide in some areas of the relaxed lung.

The selection of cases for artificial pneumothorax should be done with scrupulous discrimination. According to prevailing trends, most patients are given a reasonable trial with strict bed rest prior to the induction of pneumothorax. There are sound reasons for such attitude and only few exceptions to this program. Strict bed rest alone is a potent method in the treatment of patients with reversible forms of pulmonary tuberculosis. In addition to the obvious general benefits derived from this measure, it is well to bear in mind that a certain degree of reduction in the intrapleural suction can be accomplished by bed rest. It must be recognized that the stretch of the lung in the upright position (that I propose to designate as orthostatic hypertension of the elastic tissue of the lung) is ontogenetically unnatural. An effective reduction in the suction force of the intrapleural negative pressure is brought about by decreasing the difference between the size of the retractile lung and that of the thoracic cage. Normally, the lung automatically adjusts itself to the size of the thorax. In the recumbent position the size of the thoracic cage is reduced. Consequently, there is a decrease in the size of the lung. It is known that in the supine position the lung volume is reduced by 20 per cent. Herein lies the mechanical basis of the rationale of bed rest in the treatment of pulmonary tuberculosis.

An ideal pneumothorax must be mechanically satisfactory. Adhesions which prevent competent pulmonary relaxation should be severed as early as possible during the course of treatment. It is the consensus that a mechanically unsatisfactory pneumothorax is dangerous on account of its possible complications. It should never be forgotten that a mechanically unsatisfactory pneumothorax is *eo ipso* therapeutically

ineffective and therefore, it should be looked upon as a hazardous venture, with the patient's life at stake

Remarkable as its curative results are, it may be necessary to supplement artificial pneumothorax with other forms of relaxation therapy. Good clinical judgment, resourcefulness and freedom from therapeutic prejudice are prerequisites in this regard. Only by being cognizant of the benefits as well as the limitations of artificial pneumothorax can a good clinician use this measure to the best advantage of the tuberculous patient.

A purview of the modern management of pulmonary tuberculosis permits us to say that the universal acceptance of artificial pneumothorax in the treatment of this condition is the greatest monument the medical profession could ever have erected to the genius of Carlo Forlanini.

A L B

REFERENCE

- Forlanini C. "A Contribution to the Surgical Therapy of Phthisis: Ablation of the Lung? Artificial Pneumothorax?" *Gazzetta degli Ospedali & delle Cliniche di Milano*, 3: 537, 585, 601, 609, 617, 625, 641, 657, 665, 689, 705, 1882, translated by Lojacono, *S. Tubercle* 16: 61, 1934.

A New Medical Journal

The first issue of a new medical journal has just appeared under the title, *REVISTA PANAMERICANA DE MEDICINA Y CIRUGIA DEL TORAX*. The Editor, Donato G. Alarcon, M.D., F.C.C.P., of Mexico City, is widely known on the Western Hemisphere and throughout the world for his excellent work in clinical medicine and surgery, as well as medical journalism. It is his desire to publish up-to-date material from South, Central and North America, thus keeping all physicians in the Western Hemisphere informed on the latest developments and procedures in the field of chest diseases. This is a fine and laudible venture in medical education. The value of the journal is enhanced for North American scientists and physicians by a summary in English at the end of each article. Indeed, every journal published on the Western Hemisphere definitely increases its usefulness by publishing summaries of all articles at least in Spanish and English.

The first copy of this excellent journal contains the following articles:

"El Tratamiento del Conducto Arterial Persistente" (The Treatment of Patent Ductus Arteriosus) by Frank S. Dolley, M.D., F.C.C.P., Los Angeles, California.

"La Iniciación de la Tuberculosis en el Adulto" (The Onset of Tuberculosis in the Adult) by Gumersindo Sayago, M.D., F.C.C.P., Cordoba, Argentina.

"Concepto Sobre la Cura del Tuberculosis. Importancia del Lavado Bronquial como Índice de Efectiva Técnica" (The Importance of Bronchial Lavage in the Treatment of Tuberculosis, Describing a New Technique) by Juan J. Castillo, M.D., F.C.C.P., Havana, Cuba.

Some space is devoted to the Pan American activities of the American College of Chest Physicians. The illustrations and general format of the journal are of the highest quality.

It is fortunate that such an excellent physician and editor should be

so ideally located geographically to serve all inhabited areas from pole to pole

Although there are several fine journals devoted to thoracic diseases published in various parts of this hemisphere there are not too many. Indeed, there is ample room for another, as indicated by the increasing demand for such space. DISEASES OF THE CHEST welcomes REVISTA PANAMERICANA DE MEDICINA Y CIRUGIA DEL TORAX and stands ready to cooperate with and support Dr. Alarcon and his editorial board wholeheartedly at every opportunity.

J A M

14th Annual Meeting
AMERICAN COLLEGE OF CHEST PHYSICIANS
Congress Hotel, Chicago, Illinois
June 17-20, 1948

Chicago will be host this year to the American Medical Association and the American College of Chest Physicians, as well as to a number of other medical specialty societies that are planning to hold meetings in June. It is anticipated that there will be a large attendance and we therefore urge you to make your hotel reservations at once if you are planning to attend these meetings. Please write to the Executive Offices of the College in Chicago for hotel accommodations for the College meeting, June 17-20, and for the meeting of the American Medical Association, June 21-25 (See page xvi of this issue for hotel rates and reservation coupon).

The Program Committee assures us that the scientific program will maintain the high standards which are identified with College meetings. The program will be international in scope and topics of current interest will be discussed by leading authorities.

As previously announced, it has been voted by the House of Delegates of the American Medical Association that a Section be established on Diseases of the Chest. The first session for this newly organized Section will be presented at Chicago in June, 1948, under the Section on Miscellaneous Topics in the Scientific Assembly of the American Medical Association.

Richard H. Overholt, M.D., F.C.C.P., Brookline, Massachusetts, and J. Winthrop Peabody, M.D., F.C.C.P., Washington, D. C., have been appointed Chairman and Secretary, respectively, for this session.

All chest specialists are urged to register for the Section and attend these meetings.

RAHWAY, N. J.—Dr. Donald F. Robertson, Associate Medical Director of Merck & Co., Inc., manufacturing chemists of Rahway, N. J., died November 8th in Harkness Pavilion, Presbyterian Medical Center, New York City. A member of the Medical Division for more than ten years, Dr. Robertson joined the company after extensive postgraduate training in neurology and allied subjects. He contributed to the development of the Merck program of clinical research, and is credited particularly with important studies on penicillin and streptomycin.

Postgraduate Course in Diseases of the Chest

Sponsored by

THE AMERICAN COLLEGE OF CHEST PHYSICIANS

PENNSYLVANIA CHAPTER

and

THE LAENNEC SOCIETY OF PHILADELPHIA

March 15-20, 1948

Warwick Hotel, Philadelphia Pennsylvania

A postgraduate course in diseases of the chest will be given by the American College of Chest Physicians Pennsylvania Chapter, and the Laennec Society of Philadelphia, at the Warwick Hotel, Philadelphia, Pennsylvania, March 15-20, 1948

This course is intended to present authoritative information on all of the important recent developments in the diagnosis and treatment of diseases of the chest. A feature of the course will be luncheon round table discussions, including question and answer periods on controversial matters. The subjects to be considered in the course are listed in the preliminary outline below.

To insure informality and individual attention the class is limited to fifty members. The tuition fee is \$50.00. When the class is filled, no further applications will be accepted. Requests for further information should be sent to the Executive Offices of the American College of Chest Physicians in Chicago. A coupon has been inserted on page x of the front pages of this issue to facilitate application.

Hotel accommodations at the Warwick Hotel in Philadelphia, will be arranged on request at the time of acceptance of applications.

— P R O G R A M —

Time 9 00 a. m.

Monday Pulmonary Segments in Relation to Bronchopulmonary Diseases

Tuesday Pneumoconiosis

Wednesday Anesthesiology in Relation to Thoracic Surgery with Special Reference to Pulmonary Complications

Thursday Epidemiology and Control of Tuberculosis

Friday Principles of Medical Treatment of Pulmonary Tuberculosis with Special Reference to Artificial Pneumothorax and Pneumoperitoneum

Saturday Clinical Diagnostic Conference Hahnemann Hospital Staff

Time 10 00 a. m.

Monday Acute Respiratory Diseases

Tuesday Bronchopulmonary Physiology

Wednesday Allergic States in Bronchial and Pulmonary Conditions

Thursday Diagnosis of Pulmonary Tuberculosis and Evaluation of Activity

Friday The Effects of Antibiotics in Tuberculosis

Time 11 00 a m

Monday Mycotic Infections of the Bronchi and Lungs

Tuesday Cardiac Factors in Chronic Pulmonary Disease

Wednesday Cardiac Surgery

Thursday Tuberculosis in Children

Friday Surgery of Pulmonary Tuberculosis

Saturday Clinical Diagnostic Conference, Jewish Hospital

Time 12 noon to 2 00 p m — Luncheon and Round Table Discussions

Monday The Diagnosis and Management of Pulmonary Abscess

Tuesday Diagnosis and Management of Pleural Effusions and Empyema

Wednesday B C G , history application, and discussion

Thursday Rehabilitation in Chronic Pulmonary conditions with Special Reference to Tuberculosis

Friday Mass X-ray Surveys

Time 2 00 p m

Monday Pathology of Chronic Bronchopulmonary Diseases

Tuesday Bronchiectasis

Wednesday Bronchoscopy in Diagnosis and Treatment of Chronic Diseases of the Chest

Thursday Diagnostic and Therapeutic Clinic in Tuberculosis

Friday Psychosomatic Influences in Chronic Pulmonary Diseases

Time 3 00 p m

Monday Laboratory Methods in Diagnosis of Chest Diseases

Tuesday Surgical Treatment of Bronchogenic Carcinoma

Wednesday Pulmonary Embolism

Thursday The Use and Abuse of Rest in Pulmonary Tuberculosis

Friday Clinical Diagnostic Conference, and Demonstration of Tests for Cardio-Pulmonary Function (Barton Memorial Division, Jefferson Hospital)

Time 4 00 p m

Monday Radiological Diagnosis of Acute and Chronic Pulmonary Diseases

Tuesday Mediastinal Tumors

Wednesday Aerosol Therapy in Chronic Bronchial Infections

Thursday Diagnosis and Surgical Treatment of Esophageal Disease

Time 5 00 p m Clinical Diagnostic Conference, Temple University Hospital Staff

NOTE The luncheon, round-table discussions and afternoon program on Thursday March 18 will be presented at the Eagleville Sanatorium, Norristown, Pennsylvania

Participants and instructors will be the guests of the sponsoring societies at a banquet on Friday night, March 19, at the Warwick Hotel There will be a short program following the banquet and the subject will be "Literary Notes on Chest Diseases"

Board of Examiners

Candidates who passed the oral and written examinations for Fellowship conducted at Atlantic City, June 7, 1947

Hans Abeles, M.D., New York, New York
 Alfred Adler, M.D., Mount Vernon, Missouri
 Joseph P. Atkins, M.D., Wynnewood, Pennsylvania
 Ralph W. Ballin, M.D., State Sanatorium, Maryland
 Solomon Bauch, M.D., Newark, New Jersey
 Lewis F. Baum, M.D., South Orange, New Jersey
 Otto S. Baum, M.D., South Orange, New Jersey
 Johann S. Bornstein, M.D., Chicago, Illinois
 Katherine Boucot, M.D., Philadelphia, Pennsylvania
 J. Edmond Bryant, M.D., Evanston, Illinois
 L. James Buis, M.D., Richmond, Virginia
 Robert O. Canada, M.D., Washington, D. C.
 Pasquale Ciaglia, M.D., Utica, New York
 Joseph D. Cuono, M.D., Verona, New Jersey
 Gisela K. Davidson, M.D., Portland, Maine
 Richard Earle DeButts, M.D., Washington, D. C.
 Thomas E. Dredge, M.D., Minneapolis, Minnesota
 Benjamin Freedman, M.D., Wyanntskill, New York
 Edward M. Garment, M.D., Castle Point, New York
 William H. Glass, M.D., Hartford, Connecticut
 Leon Goldberg, M.D., New York, New York
 J. Ivan Hershey, M.D., Bryn Mawr, Pennsylvania
 John H. Hirschfeld, M.D., Baltimore, Maryland
 Gerald F. Hogan, M.D., Amherst, Massachusetts
 Isaac Horowitz, M.D., Brooklyn, New York
 Hugh L. Houston, M.D., Murray, Kentucky
 Leroy Hyde, M.D., Van Nuys, California
 Charles Hyman, M.D., Atlantic City, New Jersey
 Zohora Ismail, M.D., New York, New York
 Benjamin Israel, M.D., New York, New York
 Archibald R. Judd, M.D., Hamburg, Pennsylvania
 Samuel Kahn, M.D., New York, New York
 William S. Klein, M.D., Chicago, Illinois
 Alexander Krasnitz, M.D., New Lisbon, New Jersey
 Joseph D. Landesman, M.D., Corpus Christi, Texas
 Anthony D. Lloy, M.D., Oteen, North Carolina
 Harold A. Lyons, M.D., Washington, D. C.
 David Marcus, M.D., Cleveland, Ohio
 James W. Macdonald, M.D., Pittsburgh, Pennsylvania
 Patrick I. McShane, M.D., Washington, D. C.
 Constantine P. Mehas, M.D., Pontiac, Michigan
 Solomon Netzer, M.D., San Francisco, California
 William K. Nutzman, M.D., Kearney, Nebraska
 John A. O'Hale, M.D., Brecksville, Ohio
 Francis H. O'Neill, M.D., Pittsburgh, Pennsylvania
 Rowland S. Phillips, M.D., Glenn Dale, Maryland
 Samuel Phillips, M.D., Memphis, Tennessee
 Sam Poller, M.D., Castle Point, New York
 Solomon M. Rauchwerger, M.D., Oteen, North Carolina
 Robert E. Schell, M.D., Swannanoa, North Carolina
 Joseph Schmerler, M.D., Liberty, New York
 Reuben I. Shapiro, M.D., Detroit, Michigan
 Irving S. Shiner, M.D., New York, New York
 Harry Shubin, M.D., Philadelphia, Pennsylvania
 Robert M. Sonneborn, M.D., Wheeling, West Virginia
 J. Earle Stuart, M.D., Plainfield, New Jersey
 John T. Szypulski, M.D., Mt. Carmel, Pennsylvania
 Theodore J. Talbot, M.D., Staten Island, New York
 Joseph F. Tedesco, M.D., Castle Point, New York
 Samuel Topperman, M.D., Otisville, New York
 Albert B. Tucker, M.D., Newark, New Jersey
 Kenneth A. Tyler, M.D., Gooding, Idaho

Joseph L Versage, M D , Stockertown, Pennsylvania
Arthur John Viehman, M D , Lexington, Kentucky
Arthur D Ward, M.D , Worcester, Massachusetts
Charles M Webster, M.D , The Dalles, Oregon
Cuthbert B Young, M D , Tyler, Texas

The questions used in the written examinations were as follows

THORACIC DISEASES (MEDICAL ASPECTS)

Part I

Discuss the pathogenesis of atelectasis

THORACIC DISEASES (MEDICAL ASPECTS)

(Answer any 4 of the 5 questions)

Part II

- (1) Discuss the differential diagnosis between bronchiectasis and carcinoma of the bronchus
- (2) Outline the present day accepted treatment of lung abscess
- (3) Discuss tracheobronchial tuberculosis from the standpoint of pathogenesis, diagnosis and treatment
- (4) Discuss the etiological aspects of pleural effusion
- (5) Discuss evaluation of the effectiveness of artificial pneumothorax and the optimal time for its discontinuance

THORACIC DISEASES (SURGICAL ASPECTS)

(Answer any 3 of the following 5 questions)

- (1) In a suspected case of bronchiogenic carcinoma, what diagnostic methods would be used to confirm or exclude the diagnosis?
- (2) What are the indications for pulmonary resection in tuberculosis?
- (3) What surgical procedures are of value in bronchiectasis?
- (4) Discuss the advantages and disadvantages of phrenicectomy
- (5) Discuss the differential diagnosis of a shadow in the upper anterior mediastinum How would you arrive at a diagnosis?

BACTERIOLOGY AND IMMUNOLOGY

(Answer 3 of the following 5 questions)

- (1) Name five species of acid fast bacilli other than mycobacterium tuberculosis and discuss their pathogenicity
- (2) How could you differentiate virulent human type tubercle bacilli from other acid fast bacilli?
- (3) Discuss the physical and chemical mechanisms involved in acid fast staining
- (4) Outline the chemical composition of the tubercle bacillus and the properties of its chief constituents
- (5) Describe the growth of tubercle bacilli on artificial media

PATHOLOGY

(Answer any 3 of the following 5 questions)

- (1) Discuss the pathogenesis of lung abscess developing as a complication of acute appendicitis
- (2) Describe the gross and microscopic lesions in the lung in a case of chronic bronchiectasis
- (3) If a child aspirates a foreign body into the primary bronchus, what succession of pathological processes, structural and functional, would likely develop?

- (4) Discuss the mechanism of the process of resolution of lobar pneumonia
- (5) What are the chief differences between the usual findings in pulmonary tuberculosis in a child and in an adult?

PHYSIOLOGY

(Answer any 3 of the following 4 questions)

- (1) Define and give normal values for Tidal air, Complemental air, Supplemental air, Vital capacity, Residual air
- (2) Discuss leucocytic changes in the course of tuberculosis
- (3) Describe two techniques for determining sedimentation rate, and the normal values for each and list conditions accelerating and retarding sedimentation of red corpuscles
- (4) Outline the chemical and the reflex mechanisms controlling respiration

ANATOMY OF THE CHEST

(Answer any 3 of the following 5 questions)

- (1) Give the surface markings on the exterior chest wall which outline the location of the underlying lungs and the individual lobes
- (2) Outline briefly the lymphatic drainage of the lungs
- (3) Describe the pleural layers and give their nerve supply
- (4) Give the boundaries and contents of the various parts of the mediastinum
- (5) Discuss the anatomy and the relations of the phrenic nerve

Semi-Annual Meeting Board of Regents

The Board of Regents of the American College of Chest Physicians met in Washington D C, at the Statler Hotel, November 21 and 22, 1947 Oral and written examinations for Fellowship in the College were given on Friday, November 21, various councils and committees held meetings during the two-day session and the Board of Regents held their semi-annual meeting on Saturday, November 22

Regents and other officials of the College present for the sessions were

J C Placak, M.D, Cleveland, Ohio Chairman
Andrew L Banyal, M.D, Milwaukee Wisconsin
Dean B Cole, M.D Richmond Virginia
A Barklie Coulter M.D Washington, D C
M Jay Flipse, M.D Miami Florida
Carl H Gellenthien M.D, Valmora New Mexico
Edward A. Greco, M.D, Portland, Maine
Alvis E Greer M.D Houston, Texas
E C Harper, M.D, Richmond, Virginia
Edward W Hayes, M.D, Monrovia, California
Charles M Hendricks, M.D, El Paso, Texas
J R Herradora, M.D Jersey City, New Jersey
William A. Hudson, M.D Detroit, Michigan
Minas Joannides, M.D, Chicago, Illinois
Hollis E Johnson, M.D, Nashville Tennessee
Herbert L Mantz M.D, Kansas City, Missouri
C Howard Marcy, M.D, Pittsburgh, Pennsylvania
Louis Mark M.D Columbus, Ohio
S U Marietta, M.D, Washington, D C
Edgar Mayer, M.D, New York, New York

Jay Arthur Myers, M.D , Minneapolis, Minnesota
George G Ornstein, M.D , New York, New York
Richard H Overholt, M.D , Brookline, Massachusetts
J Winthrop Peabody, M.D , Washington, D C
Karl Schaffle, M.D , Asheville, North Carolina
Nelson W Strohm, M.D , Buffalo, New York
James H Stygall, M.D , Indianapolis, Indiana
Paul A Turner, M.D , Louisville, Kentucky
Walter E Vest, M.D , Huntington, West Virginia
Harry C Warren, M.D , San Francisco, California
Francis J Weber, M.D , Washington, D C
Roy A Wolford, M.D , Washington, D C

Murray Kornfeld, Chicago, Illinois, Executive Secretary
Harriet E Lumm, Chicago, Illinois, Asst Executive Secy

The reports and discussions presented at the meeting of the Board of Regents are given in the following agenda

Report of the President,

Major General S U Marietta, Washington, D C

General Marietta in his opening remarks, discussed in detail the newly created Section on Diseases of the Chest in the Scientific Assembly of the American Medical Association and the steps that were being taken by the College Committee on Certification in their efforts to establish an acceptable Board on Diseases of the Chest

Council on Undergraduate Medical Education,

Edward W Hayes, M.D , Monrovia, California, Chairman

The Council on Undergraduate Medical Education reported that the copy for the book entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications, for the Student, the Teacher, and the Practicing Physician," has been completed and it is expected that the book will be released by Charles C Thomas Publishers in April, 1948 The copy for the book on non-tuberculous diseases of the chest is now in preparation *Report adopted*

Council on Postgraduate Medical Education,

J Winthrop Peabody, M.D , Washington, D C , Chairman

The Council on Postgraduate Medical Education reported on the post-graduate course in diseases of the chest held at the Municipal Tuberculosis Sanitarium, Chicago, Illinois, September 15-20, 1947 This course was attended by 62 physicians representing 20 states, the District of Columbia, Canada, China, Cuba, Mexico and Spain A similar course in diseases of the chest will be given at Philadelphia, March 15-20, 1948 *Report adopted*

Editorial Board,

Jay Arthur Myers, M.D , Minneapolis, Minnesota, Chairman

The Editorial Board reported that the number of pages in the College journal "Diseases of the Chest" have been increased, but despite this, there are a large number of manuscripts still to be published It was recommended that authors be requested to condense the text and limit the number of illustrations of their papers It was pointed out that the cost of publishing the journal has risen to such a great extent, it will be impossible in the future for the College to pay for more than four illustrations for any one paper *Report adopted*

Membership Committee,

Roy A Wolford, M.D., Washington, D C, Chairman

The Membership Committee reported publication of the 1948 College Directory containing the listing of 2274 members This is the seventh issue of the Directory and the first to be published since 1943 At that time the Directory contained the names of 1255 members of the College Since the 1948 Directory was published, 153 physicians have been admitted to membership, bringing the present College membership to 2427, an increase of almost 100 per cent since 1943 The need of obtaining more Associate Fellows was stressed Members are to be requested to give particular attention to this type of applicant *Report adopted*

Report of the Treasurer

Benjamin L Brock, M.D., Louisville, Kentucky

The semi-annual financial report was referred to the Executive Council of the College The annual report of the Treasurer has been published in "Diseases of the Chest" (Vol XIII, No 5, September-October, 1947, pages 534-536)

Resolution

Since the College Board of Regents now meets twice each year, one of these meetings generally being held in November, your Treasurer wishes to recommend that the fiscal year be changed so that the books may be closed on December 31, rather than on April 30 I would further propose that the arrangements be made with the College Auditor to have this change made at the earliest possible date *Report and Resolution adopted*

National Council of Tuberculosis Committees,

James H Stygall, M.D., Indianapolis, Indiana, Chairman

The National Council of Tuberculosis Committees reported the enthusiastic luncheon meeting which was held in Atlantic City, June 8, at the time of the annual meeting of the College It is planned to hold a similar meeting in Chicago in June, 1948 *Report adopted*

Council on Public Health,

Paul A Turner, M.D., Louisville, Kentucky

Sub-Committee on Occupational Diseases of the Chest,

Louis Mark, M.D., Columbus, Ohio, Chairman

The Committee on Occupational Diseases of the Chest, which serves under the Council on Public Health, presented a progress report *Report adopted*

Sub-Committee on Chest Diseases in Penal and Mental Institutions,

Otto L Bettag, M.D., Pontiac Illinois, Chairman

The Committee on Chest Diseases in Penal and Mental Institutions, which serves under the Council on Public Health, reported on a meeting of the Committee held in Columbus, Ohio, on November 17, 1947

The following Committee members were present at the meeting Otto L Bettag, M.D., Pontiac, Illinois, Chairman, B B Bagby, M.D., Swannanoa, North Carolina, George Curtis, M.D., Columbus, Ohio, and J George Lang, M.D., New York, N Y Non-committee members present at the meeting were Oren A Beatty, M.D., Mansfield, Ohio, John V Horst, M.D., Mansfield, Ohio, Louis Mark, M.D., Columbus, Ohio, M S Lauder,

M D , Charleston, West Virginia, and Irville Spencer Rian, M.D , Mount Vernon, Ohio

A study was made of the past, present and future work, as well as a review of the progress of the Committee After open discussion the following recommendations were made

- 1 Contact the Veterans Administration for a tuberculosis survey among the mental patients
- 2 Contact the Federal Penal System for a similar view
- 3 Continue to elicit the support of the American Prison Association, American Psychiatric Association and other national agencies interested in these special groups and public health
- 4 Ask the Board of Regents to appoint to the Committee a member of the U S Public Health Service with special interest, training and experience in the immediate problem
- 5 Bring the literature on this special subject up to date

The success of the meeting suggests further sectional conferences to invite discussions of the problems in that locale The next meeting of the Committee will be held in Chicago in June, 1948

Invitations have been received from the Illinois Department of Public Safety and the Illinois Department of Public Welfare to visit the chest centers of these departments during the annual meeting of the College All other interested physicians have also been invited *Report adopted*

Board of Examiners,

Alvis E Greer, M D , Houston, Texas, Chairman

The Board of Examiners reported that 67 of the 72 candidates who took their examinations for Fellowship in the College in Atlantic City on June 5, have passed successfully The names of the successful candidates are published in this issue of the journal Nine physicians took their examinations for Fellowship in Washington, D C on Friday, November 21 The results of these examinations will be announced in a later issue of "Diseases of the Chest" *Report adopted*

Conference of College Chapter Officials,

Nelson W Strohm, M D , Buffalo, New York, Chairman

The Conference of College Chapter Officials reported in detail on the activities of the College chapters A luncheon meeting of these officials was held at the Chelsea Hotel in Atlantic City on June 5, 1947 A great deal of discussion concerning the activities and the programs of the College chapters was presented at the meeting and it was planned that a similar meeting be held at the next annual meeting of the College in Chicago in June, 1948 *Report adopted*

Committee on Certification,

J Winthrop Peabody, M.D , Washington, D C , Chairman

The Committee on Certification reviewed in detail the steps that have been taken over a period of five years to obtain a recognized board on diseases of the chest, and reported that progress is being made towards accomplishing this objective *Report adopted*

Council on International Affairs,

Herman E Hilleboe, M.D , Albany, New York, Chairman

The officers of the Council on International Affairs met jointly with the officers of the Councils on Pan American, European and Pan Pacific Affairs and reviewed the progress that has been made by the College

In countries other than the United States of America Plans are being developed for the expansion of College activities in the various countries The following resolution was proposed

WHEREAS, The American College of Chest Physicians has members in 44 countries, and,

WHEREAS It is the aim of the American College of Chest Physicians to create a world organization of qualified chest specialists, and

WHEREAS The present councils dealing with international affairs of the College do not adequately cover all of the countries in the world and

WHEREAS, At the present time there are members of the College in South Africa, Egypt and Lebanon, and

WHEREAS These and other countries in this territory do not properly fit into the present arrangement of councils,

THEREFORE, BE IT RESOLVED, That the Board of Regents of the College authorize the establishment of a Council on African and Near East Affairs and that the officers of this council be made members of the Council on International Affairs of the College
Report and Resolution adopted

Research Council,

Jay Arthur Myers, M.D, Minneapolis Minnesota, Chairman

The Research Council reported the receipt of \$17,940 in cash and pledges during the year 1947, and it was proposed that the campaign for research funds among the members of the College be intensified in order to reach the goal of \$100,000 in the shortest period of time A number of research projects were discussed and were referred to the Research Council for further consideration *Report adopted*

Council on Public Relations,

William C Voorsanger, M.D San Francisco California, Chairman

A five-point program was proposed by the Council on Public Relations After considerable discussion this report was referred to the Executive Council of the College for further study

Committee on College By-Laws,

Charles M Hendricks, M.D , El Paso, Texas, Chairman

The Committee on College By-Laws met on Friday evening, November 22, and discussed the suggested revisions in order to bring the present by-laws up to date As a great deal of work remains to be done in connection with the activities of this committee, it was recommended that the committee report to the Board of Regents at the annual meeting of the College in Chicago in June, 1948

Scientific Program Committee,

Richard H Overholt, M.D, Brookline, Massachusetts, Chairman

The Scientific Program Committee reported that preliminary plans for the program at the next annual meeting of the College are well under way and that the program this year will permit more time for the discussion of the papers presented There will also be a number of interesting symposia on topics of current interest and the program will be international in scope *Report adopted*

*Relationship of the American College of Chest Physicians
with other Societies*

After considerable discussion of this subject, the Board of Regents

renewed its pledge to cooperate with all other societies concerned with the same objectives as the American College of Chest Physicians

Dr Andrew L Banyai presented the following resolution regarding the Hyman I Spector Memorial Collection

WHEREAS, The American College of Chest Physicians has been expanding its medical educational efforts throughout the nation and abroad and the prospects are that these endeavors are likely to attain increasingly greater momentum, and

WHEREAS, Certain technical facilities are indispensable for the successful progress of such program, and

WHEREAS, The office of the Executive Secretary serves as a center of an intensified postgraduate educational campaign in cooperation and in accordance with the plans of the Council on Postgraduate Medical Education, and

WHEREAS, It seems desirable to acquire a collection of interesting lantern slides of particular teaching value which could be made available by lending to all Chapters of the College, to all recognized medical schools, and to all members of this organization without cost, and

WHEREAS, It is appropriate to cherish the memory of the late Dr Hyman I Spector, former Regent of the College and former Chairman of the Examining Board of the College, whose name as a scientist has been generally recognized in medical circles, whose devotion to the College was a shining example of loyalty and solidarity and who spared no time, expense and effort in advancing the lofty aims of this organization in the service of medical science and humanity,

THEREFORE, BE IT RESOLVED, By the Board of Regents of the American College of Chest Physicians that a collection of teaching lantern slides and other pertinent material be established as part of the College Library, under the auspices of the Council on Postgraduate Medical Education, to be known as the "Hyman I Spector Memorial Collection" and that every effort be made to maintain and enlarge said Collection by the cooperation and generosity of all concerned

There being no further business, the meeting was adjourned

Meeting of Regents and Governors in Southern States

A meeting of the Regents and Governors of the College in the Southern States was held at the Sheraton Belvedere Hotel, Baltimore, Maryland, on Sunday, November 23, 1947, at the time of the meeting of the Southern Chapter of the College Those present at the meeting were

Regents

Paul A Turner, M.D , Louisville, Kentucky,
Retiring President of the Southern Chapter, presiding
Dean B Cole, M.D , Richmond, Virginia
Herbert L Mantz, M.D , Kansas City, Missouri
Karl Schaffle, M D , Asheville, North Carolina

Governors

Carl C Aven, M D , Atlanta, Georgia
Otto C Brantigan, M.D , Baltimore, Maryland
R Kyle Brown, M.D , Greenville, South Carolina
Edgar Davis, M.D , Washington, D C
M Jay Flipse, M D , Miami, Florida
E C Harper, M D , Richmond, Virginia
R O Joplin, M.D , Louisville, Kentucky (Alt)
George R Maxwell, M.D , Morgantown, West Virginia
David H Waterman, M.D , Knoxville, Tennessee

Guests

S U Marietta, M.D., Washington, D C
 David Salkin, M.D., Hopemont, West Virginia
 Walter E Vest, M.D., Huntington, West Virginia

Dr Turner called the meeting to order and introduced Major General S U Marietta, President of the College, who was guest speaker General Marietta spoke about various activities of the College and a general discussion followed

COLLEGE CHAPTER NEWS

ILLINOIS CHAPTER

The Illinois Chapter of the College sponsored a scientific meeting at the Congress Hotel, Chicago, on Friday evening, December 5. A dinner was held at the Congress Hotel at 6 30 p m and the following scientific program was presented at 8 00 p m

The Industrial and Insurance Aspects of Chest Diseases

Industry Harold A Vonachen, M.D., Medical Director, Caterpillar Tractor Company, Peoria, Illinois

Insurance Roy W Benton, M.D., Assistant Medical Director, Northwestern Mutual Life Insurance Company, Milwaukee, Wisconsin

Chest Specialist David F Loewen, M.D., F C C P, Medical Director, Macon County Tuberculosis Sanatorium, Decatur, Illinois

The panel discussed cases, x-ray films and questions presented by physicians in the audience. All physicians were invited to bring problem cases and x-ray films for discussion.

On Thursday, January 8, 1948, the Illinois Chapter of the College and the Chicago Tuberculosis Society sponsored a meeting at the Congress Hotel at which the following program was presented:

Symposium — Experience with Streptomycin in the
 Treatment of Tuberculosis

"Tuberculous Meningitis and Millary Tuberculosis,"

Abraham A Levinson, M.D., Attending Pediatrician, Michael Reese Hospital and Associate Professor of Pediatrics, Northwestern University School of Medicine

"Tuberculosis of the Larynx and Bronchi,"

Albert H Andrews, M.D., F C C P, Associate Clinical Professor of Broncho-Esophagology, University of Illinois College of Medicine

"Acute Pneumonic Tuberculosis,"

Charles K Petter, M.D., F C C P, Medical Director, Lake County Tuberculosis Sanitarium, Waukegan, Illinois

"Surgical Treatment of Pulmonary Tuberculosis,"

S Allen Mackler, M.D., Attending Thoracic Surgeon, Cook County Hospital

"Tuberculosis of the Genito-Urinary System,"

Frederick Lloyd, M.D., Consultant in Urology, Veterans Administration Hospital, Hines, Illinois, and Assistant Professor in Urology, Northwestern University School of Medicine

"Orthopedic Tuberculosis"

Felix Gansey, M.D., Consultant in Orthopedics, Edward Miller, M.D., Resident in Orthopedics, and Bradley Carr, M.D., Resident in Orthopedics, Veterans Administration Hospital, Hines, Ill

Discussion

NEW YORK STATE CHAPTER

The New York State Chapter of the College will hold a meeting on January 29, 1948 at the Hotel New Yorker, New York City, at which time the following program will be presented

Symposium on Extra Pulmonary Complications

"Tuberculosis of the Meninges,"

Edith S Lincoln, M.D , New York, N Y

"Tuberculosis of Serous Membranes,"

Harry Wessler, M.D , New York, N Y

"Tuberculosis of the Larynx, Trachea and Bronchi,"

Speaker to be announced

"Tuberculosis of the Urinary Tract and the Use of Cali Moogrol Oil Derivative and Streptomycin,"

George Slotkin, M.D , Buffalo, N Y

"Tuberculosis of the Bones and Joints,"

Speaker to be announced

"Tuberculosis of the Gastrointestinal Tract,"

Speaker to be announced

Discussion to be opened by Oscar Auerbach, M.D , Veterans Hospital, Castle Point, New York

Dinner Speakers, Herman E Hilleboe, M.D , F C C P , New York, S U Marietta, M.D , F C C P , Washington, D C , President, American College of Chest Physicians

Dr George Foster Herben, Yonkers, New York, is Chairman of the Scientific Program Committee and serving with him on this committee are Dr James S Edlin, New York City, and Dr Donald R McKay, Buffalo, New York

PACIFIC NORTHWEST DISTRICT CHAPTER

At the Annual Meeting of the Pacific Northwest District Chapter of the College, which was held in Seattle, Washington, on October 30 and 31, 1947, the following officers were elected for the coming year

Grover C Bellinger, M D , Salem, Oregon, President

W Elliott Harrison, M D , Vancouver, B C , Vice-President

Florence A Brown, M.D , Portland, Oregon, Secy -Treas (re-elected)

The local chapter of the American Trudeau Society met jointly with the Pacific Northwest District Chapter of the College and the Northwest Trudeau Society was organized Officers of the newly created Northwest Trudeau Society are

Byron F Francis, M.D , Seattle, Washington

William Hatfield, M.D , Vancouver, B C , President-Elect

Cedric Northrop, M D , Seattle, Washington, Secretary-Treasurer

ROCKY MOUNTAIN CHAPTER

Lorenz W Frank, M D , F C C P , Denver, Colorado, President of the Rocky Mountain Chapter of the College has announced the following committee appointments for the coming year

Medical Education Committee

Fred R Harper, M D , Denver, Colorado, Chairman

Albert Guggenheim, M D , Denver, Colorado

Ralph G Rigby, M D , Salt Lake City, Utah

John A Sevier, M.D , Colorado Springs, Colorado

Membership Committee

John S Bouslog, M.D, Denver, Colorado, Chairman
Aidan M Mullett, M.D, Colorado Springs, Colorado
Carl H Gellenthien, M.D, Valmora, New Mexico
B Thomas McMahon, M.D, Denver, Colorado

Program Committee

Harold M Van Der Schouw, M.D, Wheat Ridge, Colo, Chairman
John B Grow, M.D, Denver, Colorado
H C Goodson, M.D, Colorado Springs, Colorado
Laurence J Bernard, M.D, Albuquerque, New Mexico

Publicity Committee

Allan Hurst, M.D, Denver, Colorado, Chairman
Arthur B Gjellum, M.D, Del Norte, Colorado
John G Wolf, M.D, Pueblo, Colorado

General Arrangements Committee

Arnold Minnig, M.D, Denver, Colorado, Chairman
Phineas J Sparer, M.D, Denver, Colorado
Leroy Elrick, M.D, Denver, Colorado
John A Cremer, M.D, Denver, Colorado

SOUTHERN CHAPTER

An excellent scientific program was presented at the Fifth Annual Meeting of the Southern Chapter of the College held at the Sheraton Belvedere Hotel, Baltimore, Maryland November 23-24, 1947, under the chairmanship of David H Waterman M.D, F C C P, Knoxville, Tenn. The arrangements for the meeting were handled by Otto C Brantigan, M.D, F C C P, Baltimore, Maryland, and his able committee. Dr Brantigan presided at the Banquet and introduced the guest of honor, Alfred A Blalock, M.D Baltimore Maryland. Dr Blalock presented a very interesting motion picture on "The Surgical Treatment of Coarctation of the Aorta." The following officers were elected for the Southern Chapter for the ensuing year:

Herbert L Mantz, M.D, Kansas City, Missouri, President
Dean B Cole, M.D, Richmond, Virginia, First Vice-President
David H Waterman, M.D, Knoxville, Tenn, Second Vice-President
Hollis E Johnson, M.D, Nashville, Tenn, Secy -Treas (re-elected)

The committee appointments will be announced in a later issue of "Diseases of the Chest."

WISCONSIN CHAPTER

The Wisconsin Chapter of the College sponsored a Symposium on Diseases of the Chest before the Winnebago County Medical Society on Thursday, December 4, 1947. The following papers were presented:

"Pulmonary Blastomycosis,"
David D Feld, M.D, F C C P, Milwaukee
"Cystic Disease of the Lung,"
George H Jurgens, M.D, F C C P, Milwaukee
"Atelectasis and Pulmonary Carcinoma,"
Mischa J Lustok, M.D, F C C P, Milwaukee

ARGENTINE CHAPTER

The Annual Meeting of the Argentine Chapter of the American College of Chest Physicians, took place in Buenos Aires on December 6, 1947. Dr Chevallier L Jackson, Chairman of the Council on Pan American Affairs of the College, who was visiting in South America at that time, participated in the meeting. Other officials of the Chapter present at the meeting were

Dr Gumersindo Sayago, Cordoba, Regent
Dr Raul F Vaccarezza, Buenos Aires, Governor
Dr Agustín Caeiro, Cordoba, Vice-President
Dr Alvaro E Bence, Buenos Aires, Secy -Treas

A scientific session was held at 10 30 a m on the subject of "Utilidad de la Auroterapia en el Tratamiento de la Tuberculosis Pulmonar." The speakers at this session were

Dr Antonio Cetrangolo y Juan Carlos Rey
Dr Justo Lopez (h) y Abraham Schottlender
Dr Gumersindo Sayago y Juan B Rocca

Further details of this meeting of the Argentina Chapter of the College will be published in a later issue of the journal

SOUTH BRAZILIAN CHAPTER ORGANIZED

On September 28, 1947, in the city of Sao Paulo, Brazil, a new College Chapter of the American College of Chest Physicians was inaugurated. This inauguration took place in collaboration with the 4a Conferencia Regional de Tuberculosis, of the Sociedade Brasileira de Tuberculose—Centie de Estudos do Dispensario Clemente Ferreira, held at Sao Paulo, Brazil on September 20-27, 1947.

The new College Chapter is to be known as the South Brazilian Chapter, and will be comprised of the following states: Rio Grande do Sul, Santa Catarina, Parana, and Sao Paulo. The Chapter will be supervised by Dr Eduardo Etzel, Governor of the College for the southern Brazilian states, and becomes the thirty-first chapter of the College to be organized, and the third chapter to be organized for Brazil. The other two chapters in Brazil are (1) The Central Brazilian Chapter, comprising the states of Rio de Janeiro, D F, Estado Rio de Janeiro, Espirito Santo, Minas Gerais, Gois Grasso, and Mato Grasso, and (2) The North Brazilian Chapter, comprising the states of Bahia, Sergipe, Alagoas, Pernambuco, Paraciba, Rio Grande do Norte, Ceara, Piaul, Maranhiao, Para, and Amazonas.

Dr Reginaldo Fernandes, Rio de Janeiro, is the Governor for the Central Brazilian Chapter, and Dr Jose Silveira, of Salvador, Bahia, is the Governor for the North Brazilian Chapter. Dr Affonso MacDowell, Rio de Janeiro, is the Regent of the College for Brazil, and Dr Affonso MacDowell Filho, is the Corresponding Secretary for the College Chapters in Brazil.

The meeting at Sao Paulo was attended by a large number of members of the College from the other Brazilian Chapters. Further information about this important and significant event in the activities of the College in South America, will be published in a later issue of the journal.

North Brazilian Chapter Holds Meeting

A reunion of the members of the North Brazilian Chapter of the American College of Chest Physicians, took place in Bahia, during the week of December 21-27, 1947, this meeting being in collaboration with the "Second Semana Anti-Tuberculosa" in Bahia. The meeting was attended by a large number of members of the North Brazilian Chapter of the College, headed by Dr. Jose Silveira, Governor of the North Brazilian Chapter. A special study of the problem of vaccination with BCG was presented at this meeting.

Dr. Chevalier L. Jackson Visits Brazil

Dr. Chevalier L. Jackson, Chairman of the Council on Pan American Affairs of the College, held a conference in Sao Paulo with Dr. Eduardo Etzel, and Dr. Etzel stated that the activities of the South Brazilian Chapter are progressing satisfactorily, and that a number of new applications for membership in the College will be received at the College offices from this territory in the near future.

In Rio de Janeiro, a reception was given in honor of Dr. Jackson, at the Yacht Club, by members of the Central Brazilian Chapter, and following the reception, a meeting of the members of the College was held, at which time Dr. Jackson delivered a message to them regarding the activities of the Council on Pan American Affairs of the College.



MEETING, CENTRAL BRAZILIAN CHAPTER

S. Sebastiao Hospital, Rio de Janeiro, November 20, 1947. Officers of the Central Brazilian Chapter, American College of Chest Physicians.

CENTRAL AMERICAN CHAPTER ORGANIZED

The Central American Chapter of the American College of Chest Physicians was organized in the city of San Salvador, El Salvador, C A, on November 14, 1947 The meeting was held in the Sanatorio Nacional Anti-Tuberculosis This new Chapter now becomes the thirty-second College Chapter, and adds an important milestone towards a complete organization of College Chapters in the Western Hemisphere The session was attended by Dr Amadeo Vicente Mastellari, Regent of the College for Central America, and by the following Governors of the College in Central America

Dr Gonzalez Bonilla, San Salvador
 Dr Enrique Coronado Iturbide, Guatemala
 Dr Rene Vargas Lopez, Nicaragua
 Dr Maximo Carrizo, representing the Governor from Panama

A large number of College members in Central America also attended the meeting Following the reading and approval of the College by-laws, the physicians named below were elected to office

President Dr Rafael Leal H, Guatemala
 Vice-President Dr Maximo Carrizo, Panama
 Secy-Treas (Provisional) Dr Fausto Aguilar, Guatemala
 Directors Dr Arturo Blanco Solis, Costa Rica
 Dr Hector Valdez, Santa Ana, San Salvador

The meeting was held jointly with the Asociacion Centro Americana de Tisiologia, and it was decided to send the delegates of that body a congratulatory message wishing them success in their endeavors To celebrate the inauguration of the Central American Chapter of the College, a banquet was held on the evening of November 14th It was voted that the next meeting of the Chapter should be held in Guatemala City, Guatemala

 THIRD ANNUAL MEETING OF THE PERUVIAN CHAPTER

The Third Annual Meeting of the Peruvian Chapter of the American College of Chest Physicians, was held at the Central Dispensario, Lima, Peru, on December 26, 27 and 29, 1947 The following scientific program was presented

December 26th

"Criterio de Hospitalizacion en Tuberculosis,"

Prof Dr Ovidio Garcia Rosell

"Indice de infeccion y morbilidad tuberculosa en postulantes a la Universidad Nacional Mayor de San Marcos,"

Prof Dr Juan A Werner

"Investigacion de la infeccion tuberculosa entre los enfermos mentales del Hospital 'Larco Herrera,'"

Dr Luis Cano Girona

"Importancia del despistaje y del factor cultura en la lucha anti-tuberculosa,"

Dr Luis E Hubner

December 27th

"Sobre un caso de probable consinofilia tropical,"

Dr Max Espinoza Galarza

"Granulía pulmonar tuberculosa en la infancia,"

Dr Horacio Cachay Diaz

"Asociacion de tuberculosis y absceso pulmonar,"

Dr Leopoldo Molinari B

"Tomografia en lesiones pulmonares apicales,"

Dr Mario Pastor B

"Absceso pulmonar,"

Dr Pedro Zevallos A

December 29th

"Calcificaciones pleurales"

Dr Ramon Vargas Machuca

"Neumotorax bilateral,"

Dr Juan Escudero Villar

"Un caso de empiema cronico,"

Dr Victor M Tejada

"Neumoserosa como tratamiento de las pleuresias,"

Dr Roman del Castillo

The names of the new officers and directors of the Chapter will be announced at a later date

POSTGRADUATE COURSE TO BE GIVEN IN URUGUAY

The Fifth Curso de Perfeccionamiento Terico Practico—Problemas actuales de Clínica Tisiologica will be held at the Instituto de Tisiologia "Prof Juan B Morelli" (Director Prof Dr Fernando D Gomez), Facultad de Medicina de Montevideo, on Marzo 1 al 13 de 1948 The following members of the American College of Chest Physicians will participate in this program Prof F D Gomez, Prof P Purriel, Prof A R Gines (Paraguay), Dr A Victorica, Dr D A Piaggio, Prof J Soto Blanco, and Dr V Armand Ugon

Dr Chevalier L Jackson Visits Uruguay

During his trip through South America, Dr Chevalier L Jackson held a conference with Dr Fernando D Gomez, Montevideo, Governor of the College for Uruguay, and Dr Gomez stated that the chest specialists in Uruguay are now preparing to organize a Chapter of the College in that country Further details of the organization of this new College Chapter will be published in a later issue of the College journal

NEWS NOTES

An excellent postgraduate refresher course in pulmonary tuberculosis was presented at the State Sanatorium Tom Green County, Texas, the week of November 17-22, 1947 A number of physicians attended the entire course and visiting physicians attended the daily meetings from San Angelo and other points in West Texas The next postgraduate course for Texas physicians will be offered by the State Sanatorium in the spring, probably in April 1948 Physicians may make reservations for this course by writing the Superintendent, State Sanatorium, Sanatorium, Texas

Announcement has been made of the Mount Sinai-Duarte National Medical Center, which is a consolidation of the Jewish Consumptive Relief Association, the Los Angeles Sanatorium, and the Mount Sinai Hospital and Clinic The national headquarters are at 208 West Eighth Street, Los Angeles, California

A new journal entitled "Revista Americana de Fisiologia" is now being published in Havana, Cuba. Dr. Juan J. Castillo, a Fellow of the American College of Chest Physicians, is Director and Founder. This new journal will be of interest to members of the College throughout the world.

Walter E. Vest, M.D., F.C.C.P., Huntington, West Virginia, has been re-appointed as president of the Public Health Council of the West Virginia State Medical Society. He has been a member of the Council since 1933, and has served as its president since 1937.

At a combined meeting of the Alumni of the Massachusetts Eye and Ear Infirmary and the New England Otolaryngological Society, which was held in Boston on November 19, Arthur Q. Penta, M.D., F.C.C.P., of Schenectady, New York, presented a paper on "The Role of Bronchoscopy in Clinical Medicine and Surgery."

George Evans, M.D., F.C.C.P., Clarksburg, West Virginia, was the guest speaker at the regular quarterly dinner meeting of the Central West Virginia Medical Society, September 25, 1947, in Buckhannon. The title of his paper was "Spontaneous Pneumothorax."

The following members of the College participated in the program of the American Medical Association presented during the Interim Session at Cleveland, Ohio, January 5-8, 1948:

Alvan L. Barach, M.D., F.C.C.P., New York, N. Y., led a discussion at the Conference on Respiratory Infections.

Alton Ochsner, M.D., F.C.C.P., New Orleans, Louisiana, led a discussion on the "Care of Posthospitalized Patient with Cancer."

Herman E. Hilleboe, M.D., F.C.C.P., Albany, New York, presented a paper entitled "BCG and Tuberculosis."

Leo G. Rigler, M.D., F.C.C.P., Minneapolis, Minnesota, presented a paper on "What Can Be Seen in a Roentgenogram of the Chest?"

AMERICAN COLLEGE OF PHYSICIANS RESEARCH FELLOWSHIPS IN MEDICINE, 1948 AWARDS

The Board of Regents of the American College of Physicians, on the nomination of the Committee on Fellowship and Awards, awarded six Research Fellowships in Medicine for the year beginning July, 1948, at their meeting in Philadelphia on November 22 and 23, 1947. The awards were made to the following physicians:

Charles G. Campbell, M.D., Vancouver, B. C.
Frank H. Gardner, M.D., San Bernardino, California
Samuel P. Martin, M.D., Durham, North Carolina
Peritz Scheinberg, M.D., Miami, Florida
Lutfu L. Uzman, M.D., Istanbul, Turkey
John M. Weller, M.D., Ann Arbor, Michigan

DISEASES *of the* CHEST

VOLUME XIV

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NUMBER 2

S Y M P O S I U M on D i s e a s e s o f t h e C h e s t

Presented at a meeting sponsored by the Laennec Society of Philadelphia and the Pennsylvania Chapter of the American College of Chest Physicians, Philadelphia, Pennsylvania, April 3, 1946

Scientific Session,

Martin Sokoloff, M.D., President, Laennec Society, presiding

- *"Changing Concepts in the Bed Rest Treatment of Tuberculosis,"
R S Anderson, M.D., F C C P, Erie, Pennsylvania

"Penicillin and Streptomycin in the Treatment of Tuberculous and Non-Tuberculous Broncho-Pulmonary Disease,"
John Kolmer, M.D., Philadelphia, Pennsylvania

- *"Tuberculous Disease of the Trachea and Bronchi,"
A R Judd, M.D., F C C P, Hamburg, Pennsylvania

- *"Tuberculosis Control in the Army,"
Esmond R Long, M.D., Philadelphia, Pennsylvania

Luncheon Speakers,

*J Winthrop Peabody, M.D., F C C P, Washington, D C
C Howard Marcy, M.D., F C C P, Pittsburgh, Pennsylvania

Scientific Session,

Ross Childerhose, M.D., F C C P, President, Pennsylvania Chapter, American College of Chest Physicians, presiding

- *"Pulmonary Cysts,"
Burgess Gordon, M.D., F C C P, Philadelphia, Pennsylvania

- *"Early Clinical Features of Bronchogenic Carcinoma Illustrative Cases,"
Charles M Norris, M.D., F C C P, Philadelphia, Pennsylvania

"Cytology of Bronchial Secretions in the Diagnosis of Cancer,"
P A Herbut, M.D., and Louis H Clerf, M.D., F C C P, Philadelphia, Pennsylvania

"Bronchoscopy in Some Types of Atelectasis,"
John S Packard, M.D., F C C P, Allenwood, Pennsylvania

"Differential Diagnosis of Broncho-Pulmonary Disease,"
W E Chamberlain, M.D., Philadelphia, Pennsylvania

Dinner,

Toastmaster, Chevallier L Jackson, M.D., F C C P, Vice-President, Pennsylvania Chapter, American College of Chest Physicians, and Past-President Laennec Society of Philadelphia

Speaker, Richard H Overholt, M.D., F C C P, Brookline, Mass.,
"Lung Resection in Broncho-Pulmonary Tuberculosis"

*These papers are published in this issue of "Diseases of the Chest"

Address *

J WINTHROP PEABODY, M.D., F.A.C.P., F.C.C.P.**

Washington, D. C

I think that the great French internist René-Théophile-Hyacinthe Laennec would be greatly pleased if from that heaven to which all good physicians surely go he could look in upon this gathering today. He would be glad to know, that one society which bears his name and another society which bears his likeness on its seal should be meeting together in fulfillment of the purpose for which they were both organized and in the attainment of which he not only spent his life but gave his life.

The purpose of the Laennec Society of Philadelphia and of the American College of Chest Physicians, of which the Pennsylvania Chapter is a part, is the same, the advancement of knowledge concerning diseases of the chest. The great Sir William Osler once spoke of the impenetrable barrier interposed by the abdominal wall between the physician and the knowledge he must have to treat the patient aright. The similar barrier which once barred the chest physician from the knowledge he also needs has also been swept away, first by the stethoscope devised by Laennec in 1816, then 80 years afterwards, by the discovery by Roentgen of the ray which bears his name. Those two dates are mile-stones in the history of diseases of the chest. Before Laennec, it has been properly said, methods of physical examination had scarcely changed since the days of Hippocrates, except possibly to deteriorate a little. Before Roentgen, even after the physician had been made to hear by Laennec's invention, his eyes remained blinded.

It is interesting to look back on the giant strides made in diagnosis and treatment of diseases of the chest in the bare dozen years of existence of the American College of Chest Physicians. Bronchoscopy has been greatly improved. Bronchspirometry now permits functional testing of the lung. Tomography now permits exact localization of pathologic processes. As a result of these diagnostic procedures, carcinoma of the lung and other neoplasms are now susceptible to early diagnosis, and pneumonectomy is now a practical procedure, to which many men already owe their

*Presented at a symposium on Diseases of the Chest, at a meeting sponsored by the Laennec Society and the Pennsylvania Chapter of the American College of Chest Physicians, Philadelphia, Pennsylvania, April 3, 1946.

**Professor Diseases Respiratory System, Georgetown University

lives, and not a surgical curiosity. Such new entities as virus pneumonia and ornithosis have been recognized and investigated. The sulfonamides and penicillin have reduced the mortality of pneumonia to a point which 10 years ago we did not dream possible, and they have enormously reduced the mortality of such formidable diseases as empyema and lung abscess, whose incidence, for that matter, they have also reduced. Finally, and in the opinion of many of us most important of all, mass tuberculosis surveys have become a reality. All of these things, as I say, have happened within the lifetime of the American College of Chest Physicians.

The College, I believe, is properly organized to take the fullest advantage of the new knowledge of diseases of the chest. It was founded to bring together men who devote all of their time, or a large portion of their time, to teaching or treatment or research investigation of diseases of the chest. It therefore includes in its membership not only internists but also thoracic surgeons, radiologists, bronchoscopists, otolaryngologists and pathologists. Requirements for election to fellowship are exacting, but within the framework of exactitude are nonetheless liberal. The aim of the society is to emphasize the relationship between physicians who specialize in diseases of the chest and physicians who engage in the general practice of medicine, while at the same time emphasizing the standards which men who are specialists must establish and maintain.

The most important function of the College is to further medical education, both post-graduate and under-graduate. All of its meetings, like this one, are in effect post-graduate assemblies. They are so planned that their value is not limited to Fellows of the College but can be shared by all physicians. The College, as a matter of fact, is founded upon a pyramid of other societies, local, state, regional and national, and this joint session, participated in by the Laennec Society of Philadelphia and the Pennsylvania Chapter of the College, has been duplicated dozens of times in many parts of the country.

Important as its post-graduate educational function is, however, the College promptly realized that a major part of its educational effort must concern the undergraduate teaching of diseases of the chest, on the concept, frequently more honored in the breach than in the observance, that the tree will incline as the twig is bent. One of its earliest efforts, therefore, was a long-term survey of the facilities and methods for the teaching of tuberculosis in the medical schools of the United States and Canada. The report of the Council on Undergraduate Medical Education was, unfortunately, pessimistic. Both facilities and methods were found to be

wholly inadequate That the conclusion was fair and impartial is borne out by the fact that most of the deans of the colleges and the heads of the departments of medicine investigated were in complete agreement with the report of the Council The purpose of the Council was not to criticize shortcomings but to assist in remedying them, and the teaching manual now going through the press is one way of doing so Incidentally, when it is completed, other manuals on other diseases of the chest will follow

A significant educational effort of the College has been the organization of state and county and city committees on tuberculosis When the work was first undertaken, only six states had such committees Now they are functioning in almost every state, several states have them in almost every county, and they are active in many cities I think it fair to say that our ultimate objective, a tuberculosis committee in every local medical society, may soon be attained It is essential that it should be Pronouncements from high places will not solve the problem Tuberculosis is a national and world-wide disease, it is true, but it is first of all a local problem, and its solution will come first on the local plane

The viewpoint of the College is, however, truly international Before the war there were Fellows in almost every country in the world, and organized chapters in several Expansion was abruptly ended with the outbreak of hostilities in all the zones of combat, though expansion in Central and South America never ceased The abstracts in Spanish which appear at the end of every article in the official journal, *Diseases of the Chest*, is testimony of the interest of the Fellows in the Southern countries of the Western Hemisphere With the end of hostilities contact with Fellows and chapters elsewhere is rapidly being revived, and it cannot be revived too promptly I need not remind you that tuberculosis is one of the plagues which ride with the Horsemen of War and Famine and Disease

I have not meant, of course, to minimize other diseases by dwelling at such length on tuberculosis On the other hand, while this disease may no longer be Captain of the Men of Death, it yielded that preeminence unwillingly, and it may readily regain it We need not look further than the products of the German concentration camps to realize that

We have made many advances in tuberculosis—pneumothorax, phrenic crushing, pneumoperitoneum, intrapleural pneumonolysis, stage thoracoplasty, lobectomy, pneumonectomy But case finding is still the most important of all considerations, and the mass surveys already made suggest the presence in this country of perhaps 1,500,000 tuberculous subjects, which scarcely furnishes

grounds for complacency From the standpoint of public welfare societies such as those meeting here today must rise to that diagnostic and therapeutic challenge We must identify those persons, and we must teach them and their families, and I am afraid some of our own profession, that the old and tried, and I grant trying, method of bed rest and other supportive measures is still the basic therapy, everything else being adjunct The earlier the disease is identified, in fact, the less do we need any other measures

But let me go back to Laennec I have no doubt that he would have looked at the program we are presenting today with a great deal of interest He would have approved of papers dealing with pulmonary tuberculosis and tuberculous bronchopulmonary disease and tuberculous tracheobronchitis, for 40 years before Koch identified the organism that proved his thesis he taught that tuberculosis, wherever it was located, was a single disease He probably would not have recognized certain of the diseases to be discussed on our afternoon program, but he was a sound pathologist—sounder, I fear, than some of us here, in which group I hurriedly place myself—and he would quickly have comprehended whatever he did not understand But diagnosis by cytology and bronchoscopy, treatment by penicillin and streptomycin and lung resection, those things would have been beyond his knowledge at least until a good deal of background had been filled in

Laennec achieved his medical knowledge the hard way, and it might profit us to recall how he accomplished what he did When he was not yet 15 years of age he put away childish things and began the study of medicine While still in his teens he was a health officer in the French Army At the age of 20, almost penniless, he reached Paris, then the city of medical light, where the system of medical education was curiously compounded of tradition and clinical science The curriculum included lectures on Hippocrates three times a week, but students were led from the wards to the postmortem room, their teachers were great anatomists and pathologists, and one of them, a 17-hour-a-day man, as he was described, had himself performed autopsies on more than 900 tuberculous patients

Laennec's industry and intelligence and burning ambition quickly commended him to those men The year he graduated he was awarded the prizes in medicine and surgery, two of the four awards offered He wrote on such widely different subjects as cancer, melanosis, ascaris and hydatid disease He first described the deltoid bursa, bronchiectasis, hemorrhagic pleurisy, pulmonary gangrene, pulmonary infarct, emphysema, esophagitis, interstitial hepatitis, and perforating carcinoma of the stomach He left classic descriptions of pneumonia and bronchitis In 1816, at the age of

35, he devised the stethoscope, which he left to his nephew when he died—ironically of tuberculosis—as “the best part of my succession ”

And so it was For the stethoscope led to his first book on mediate auscultation, published in 1818, with a preface from the Royal Academy of Science so guardedly worded that its apparent commendation could instantly have been withdrawn if the book had failed It did not But Laennec, broken in health, with the first manifestations of his fatal disease upon him, had to retire from practice for two years Then he returned to honor and fame, and to heartbreaking work on the second edition of his book, which for all practical purposes was a new book He died in 1826, almost as soon as it came from the press “I knew that I risked my life,” he wrote, “but the book that I am going to publish will be, I hope, of more value than the life of a man, and in consequence my duty was to finish it, whatever might happen to me ”

I need not remind you that the modern stethoscope, which the modern medical student so proudly drapes from his pocket on his first introduction to clinical medicine, began as the crude roll of paper through which Laennec 130 years ago first listened to the sounds within the chest I need not remind you that the whole modern concept of diseases of the chest stems from this man's work It is eminently proper that we pause at intervals, as we are doing today, to remind ourselves of this man and what he achieved, and to question ourselves, in all seriousness, as to whether we are making such use of our magnificent equipment and our modern scientific methods and our unlimited opportunities which this young country boy made of the poor tools of his medically benighted day

I doubt that we are The roentgen-ray has not officially replaced the stethoscope, but I sometimes wonder, as I see patients in consultation, whether that is not about to happen It is the business of our two societies to see to it that it does not We must utilize all the resources of modern medicine, but we must use them wisely and intelligently, and we must remember, and see to it that students are made to remember, that God gave us eyes and ears and fingers before man devised the x-ray machine and other auxiliary methods

One way to achieve that end is by the continuation of such meetings as these, where men of good will, with specialized interests, meet to exchange their knowledge and experience and to learn from each other And so I end as I began I think Laennec would like to be here today

Changing Concepts in the Bed Rest Treatment of Tuberculosis*

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It would be a rare experience, indeed, to discover a phthsiologist today who will frankly admit a disbelief in the therapeutic value of bed rest in the treatment of pulmonary tuberculosis. Yet, despite the volumina of printed and spoken word on the subject in the past half century there is still considerable divergence in the mode of its application clinically. The logical ascendancy of surgical measures and so-called collapse therapy in recent decades has seemingly distracted our interest from the basic principle of rest in bed. This is not to say that it is seldom employed because, on the contrary, bed rest is probably used nearly as much today as previously. When it is considered that rest is the very basis for our entire therapy, far too little thought is given it in the medical literature of the day.

Historically, the use of rest in tuberculosis is about as old as medicine itself. From the time of Galen and Hippocrates down through the ages to the premodern era rest and relaxation have played an occasional part in the management of the consumptive. Its use, however, was rarely in the definitive sense and usually occurred coincidental to some other prescribed form of treatment. Commending the tuberculous patient to a short sea voyage or a sojourn in the country, for example, often no doubt resulted in some measure of rest. Deprived of his customary pursuits the tuberculous individual was disposed to rest by sheer force of circumstances more than he had previously in his normal habitat.

It may be a whimsical commentary on such observations to recall Thomas Sydenham's practice of keeping his phthysical patients in the saddle for as many hours each day as horse and rider could tolerate. By contrast with the then not un-common prescription of long walks in the hills this custom probably constituted a modified form of rest. Lawrason Brown observed that the practice followed Sydenham for nearly a century. Those familiar with Trudeau's autobiography will recall that the eminent

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Dr Janeway, on corroborating the diagnosis of pulmonary tuberculosis in Trudeau's chest, advised him "to go South, stay out in the open, and ride horseback "

In the nineteenth century, two hundred years after Sydenham, Peter Dettweiler was the first to really grasp the significance of rest in the therapeutics of this disease. Popularization of Dettweiler's principles based on his work under Brehmer at Gorberdorf and later in his own institution in Falkenstein, Germany, constituted one of the less heralded milestones in the long campaign against the ancient plague.

A decade later Edward Livingston Trudeau, established the Adirondack Cottage Sanatorium and instituted a regimen which placed high store on the value of general body rest. Unfortunately, the magnitude of Trudeau's genius and personality together with the amazing innovation which he had set up in that scenic locale of lakes and mountains have obscured the significance of Trudeau's experience with the principle of rest in the treatment of his own case of tuberculosis as well as that of his patients. In other respects, enthusiasts in many parts of the country were prompt to emulate the Saranac Lake experiment as closely as possible. High wooded areas were selected for the erection of cottage sanatoria, patterned after the Adirondack motif. Emphasis in treatment was placed on the environment and the "out of door life" rather than specifically on rest. Relaxation periods, principally in reclining chairs, alternating with out-door walks and an endless round of hyper-alimentation, often to the point of nausea, constituted the roster of the day. Rest was looked upon as a valuable adjuvant capable only of refreshing the patient and tending to restore his vitality.

The foregoing period persisted for ten or twenty years and more after the turn of the century. In fact, as late as the year 1918 Joseph Pratt¹ found it necessary to publish a paper entitled "The Importance of Prolonged Bed Rest in the Treatment of Pulmonary Tuberculosis." The editor of the American Review of Tuberculosis, the late Allen Krause, was so impressed with Pratt's timely contribution that he published an editorial on the subject in the same issue of the Review. Said Krause,² "Until the time comes when every tuberculosis patient, upon being asked what is the most important element in the treatment of tuberculosis will unhesitatingly answer 'Rest' the subject will always be timely. This happy day has not yet arrived. Today (1918) almost thirty-three years after Trudeau set down his first patient on the small porch of the Little Red, 'fresh air' and 'putting on weight' still dominates the therapeutic field."

Despite these warnings many leaders continued to regard rest

as an expedient to be used only when the patient is febrile or otherwise afflicted with symptoms of frankly progressive disease. The writings of Maurice Fishberg³ illustrate the prevalence of this conception as of the year 1922 "It is clear" wrote Fishberg, "that all active cases with fever, tachycardia, anorexia, emaciation, weakness, etc., are to be kept strictly at rest until most of these symptoms have disappeared." He further stated, "the rate of the pulse is as good an index of the fitness of the patient to work as there is."

It was about this time, that is, in the early 1920's that the more general use of roentgenological examinations came into practice. With improvement in x-ray equipment and technique, and particularly with the epic-making interpretative studies of Dunham, Cole, Amberson, Heise and Samson in this country and investigators such as Kupperle and Graff and others in Europe our conception of the mode of progression and retrogression of tuberculous pulmonary lesions became far more accurate than previous clinical methods had ever been able to reveal.

As a direct result of these developments in the field of x-ray and, to a lesser extent, to a broadening and refinement of clinical laboratory techniques, the need of prolonged bed rest was clearly demonstrated. Cavities could many times be visualized in the lungs where physical signs aroused no suspicion of their presence. Extensive pathological change could be witnessed in the presence of little or no untoward symptomatology. There is little reason to wonder, therefore, why revolutionary changes in the management of the active cases of tuberculosis followed these developments in methods of precision.

By 1930 a considerable percentage of American sanatoria had so modified their treatment methods that prolonged bed rest became the rule, although it must be observed that some institutions patronized the principle more in theory than in practice. Other sanatoria continued to place emphasis in treatment on the old motif of environment and a well routinized life rather than on the generally accepted modality of rest.

For the sake of clarity, it should be stated here that this thesis is not to be construed as depreciating the great value of such factors in treatment as fresh air in a wholesome environment or an adequate dietetic regimen, etc. In fact, the essayist is old-fashioned enough to regret the elimination of "cure porches" in the modern architectural designing of sanatoria. Oxygen supply and air conditioning in their broadest meaning do not constitute the summation of all the apparent benefits of life in the open air. Among other things, there is a psychological factor present on the open porch which no amount of residence in an indoor ward

can provide, despite the proficiency of modern ventilation engineers This is particularly true during the milder months of the year when the panorama of the seasons has its greatest appeal Nevertheless, it is the opinion of many authorities that the single factor of rest in bed surpasses all of these considerations in importance to recovery

The perfections realized in the field of roentgenology also demonstrated the great need for local measures to be applied directly to the chest Thus, it was not until 1930 or shortly thereafter that such methods became universally employed to any considerable degree With the widespread use of pneumothorax and the more strictly surgical methods of collapse the role of general body rest was again partially submerged in the massive literature pertaining to these newer methods The effect has been somewhat paradoxical

In many instances those who were most enthusiastic in the use of collapse therapy became also more convinced of the great value of prolonged, twenty-four hour per day rest in bed They seemed to conclude, and no doubt with some logic, that if local rest to the lung can accomplish so much of value, generalized rest must likewise furnish something of importance On the other hand, others took the position that collapse therapy eliminated much of the necessity of prolonged rest in bed and guided the clinical course of their patients accordingly

It is noteworthy that there has been but little published on the value of an intensive collapse therapy program in the absence of the concomitant use of prolonged bed rest Yet, various institutions are endeavoring to treat patients in just that manner as will be discussed in this paper On the other side of the picture, many collapse therapy results supported by an intense use of generalized rest have been published

In 1937, for example, Leslie and Anderson⁴ reported the results in a study covering 1124 patients in 78.8 per cent of whom various forms of collapse measures had been employed On discharge 48.8 per cent were classified as "arrested" or "apparently arrested" which is commendable in view of the fact that 89 per cent of the group were in the advanced stages of the disease on admission Leslie and Anderson compared their results to the Jessamine Whitney⁵ N.T.A. statistics which covered 42,107 patients in 278 Civilian Sanatoria for the year 1931 Among the latter group it is estimated that only ten per cent of this huge number of patients received collapse therapy and prolonged bed-rest was employed in these institutions in a greatly varied manner Whitney discovered only 17 per cent arrested or apparently arrested against Leslie and Anderson's 48.8 per cent In a much smaller series than the latter but with treatment very similar to that of the Leslie

and Anderson group, Hanna⁶ reported arrestment or apparent arrestment in 54.9 per cent of admissions. The foregoing studies have been quoted many times in the past in support of the principle of collapse therapy. It should be emphasized that part of the credit is due the basic program of bed-rest employed.

In 1927 the large William H. Mayberry Sanatorium⁷ at Northville, Michigan was using a very makeshift system of bed rest, and collapse therapy in only twenty per cent of admissions. Shortly thereafter this institution reorganized and resorted to a rigid program of bed rest for unstable lesions, etc. The use of pneumothorax and surgical collapse was increased to 77.7 per cent of admissions instead of 20 per cent. In four years the percentage of "apparently arrested" (this institution apparently did not employ the term "arrested") rose from 8.1 to 34.1 per cent.

In a similar manner Jerome Head⁸ compared improvement in results in a series of 600 patients at the Edward Sanatorium treated with 24-hour rest and with collapse therapy used in 60 per cent to an earlier group treated with only partial bed rest and collapse in but 10 per cent. The earlier group were reviewed six years after discharge and 27 per cent were found well, 51 per cent had died and in the balance the condition was unknown. In the later or more intensely treated group, reviewed after a period varying from three to eight years subsequent to discharge, 96 per cent of the minimal cases were well as compared to 59 per cent of the earlier series. In the moderately advanced classification the figures were 83 and 45 per cent respectively, and in the far advanced cases 41 per cent were well for the last group and only 15 per cent for the earlier series at the time of their respective follow-up studies. There were far fewer deaths found in the follow-up of the more recent group compared to that of the six-year review of the earlier series.

The encouraging sequelae of treatment as noted in these various reports not only reflects the increased use of collapse therapy in the forementioned institutions, but we must also reckon with the fact that all of the sanatoria cited employed close to 24-hour bed rest over a prolonged portion of the hospital residency, regardless of whether or not collapse measures were used or when they were used in the individual case. It would be most difficult, of course, to accurately evaluate the proportionate good effects of generalized body rest and local functional rest of the lungs in such studies.

Fales and Beaudet⁹ published several papers on the ability of bed rest alone to close cavities, particularly those which were young and with non-rigid walls. In two series totalling 237 cavities, he observed that 66 per cent healed on the bed rest regimen.

alone without resort to pneumothorax or surgery Older and more productive cavities healed in 43 per cent of Fales and Beaudet's groups, and fibrotic cavities in only 17 per cent

It is not germane to this discussion to enter here into the debatable subject of just when collapse therapy should be employed in the course of treatment One might observe, however, that the more rigid indications for the induction as well as abandonment of pneumothorax which are now recognized and which have been so fully discussed of late by Rafferty¹⁰ would make it inadvisable to long deny properly selected patients the benefits of pneumothorax even though bed rest alone might eventually close their cavities Nevertheless, Fales has clearly demonstrated the value of bed rest as a fundamental consideration The writer is disposed to agree in the main with his observation that, "Rest treatment means to some,—rest in bed eight hours at night, one or two hours rest in the morning and one or two in the afternoon, the patient being left to his own devices the remainder of the time To others it means absolute control and supervision during the entire 24 hours, with rest ranging from 22 to 24 hours in bed, and absolute rest where response is slow to lesser amounts Only those who adapt the latter regimen can expect consistent results from rest in the healing of cavities "

All who carefully employ bed rest during the early months of treatment are impressed with certain clinical observations Those patients who cooperate, relax and rest well in bed—other things being comparable—do better on the average than the patient who either cheats or will not or cannot relax and spends his days with no end of muscular and mental expenditure of energy though he nominally is a bed-patient We all have been impressed at times with the greatly improved progress such restless fellows exhibit when they are finally prevailed upon to rest properly Sometimes, as has often been said, the fright occasioned by a brisk hemoptysis is a blessing in disguise for these individuals

There are other approaches for assessing the value of continued body rest To illustrate, in the early studies of Leslie and Anderson, there was included a patient who presented a huge excavation involving almost an entire upper lobe Her pulmonary disease was complicated by an advanced upper thoracic tuberculous spondylitis with para-vertebral abscess With no hope of realizing a recovery, this woman was placed on a Bradford frame to immobilize her spine and afford a degree of comfort in that region during the remaining months of her life After many weeks of this treatment the hospital staff was astounded to note that the Potts disease had not only stabilized sufficiently to warrant surgical fusion but the huge pulmonary cavity had greatly reduced

in size and later disappeared. She was eventually discharged as an "apparently arrested" case.

Less dramatic but striking results were later observed on a fair number of patients with advanced pulmonary lesions complicated by Potts disease and similarly treated. The staff at this hospital, The Michigan State Sanatorium, were so impressed with these observations that the Bradford frame treatment was used in a number of advanced pulmonary cases in whom there was no complicating bone lesions but whose very advanced pulmonary disease could not be treated effectively by collapse therapy. LeBoe and Leslie¹¹ have collected around sixty cases treated on Bradford frames, both with and without spinal lesions. Due to the War this study has not been published but LeBoe states that the results were good in fifty to sixty per cent of the predominantly exudative cases found among the group. This method of treatment constitutes an extreme degree of general rest.

Unexpected and quite similar results have been experienced at the Erie County (Pennsylvania) Tuberculosis Hospital in a small series of individuals with advanced pulmonary lesions complicated by bone lesions treated with plaster body casts for periods of many months. The series is too small at this time to enumerate in detail and will probably warrant critical study later when there are more such cases to present.

Another illustration of enforced general and local rest is the small series of cases which Barach¹² has treated in an equalizing alternating pressure chamber similar to the original Thurnberg apparatus. By alternating variations in pressure, respiration is carried on with very little or no movement of the muscles of respiration. The five cases so treated over a period of several months were advanced cavity cases unsuitable for collapse therapy. Remarkably encouraging results were experienced in four of the five patients acclimated to the Thurnberg Chamber and who showed little or no improvement with ordinary treatment.

These several series are not large enough to warrant sweeping conclusions to be drawn from them. Nevertheless, they all tend to support the position of those who believe in the necessity of prolonged general rest. Those of us who adhere to that point of view are conscious of the limitations of bed rest and the innumerable difficulties in keeping such treatment in force. The dangers of inadequate cavity drainage by an extreme and injudicious use of bed rest so aptly described by Peck and Willis¹³ of late are fully realized. This applies equally to the futility of holding down continuously in bed certain "good chronics,"—to use Lawrason Brown's term,—who suffer from extensive fibrosis and emphysema and in whom curative results cannot be reasonably anti-

ipated Similar judgment should be used as indicated with the infirm aged and those who for psychosomatic reasons cannot tolerate a severely restricted regimen Then too, one is always confronted with the perennial dilemma of the bed-pan, whether it involves less exercise to use a bedside commode, or to be wheeled to and from a toilet than to struggle with the physical laws of balance and gravity trying to utilize a pan in bed While these and other considerations often create permissible exceptions, they should not compromise the fundamental principle with the vast majority of patients

At the outset of this paper it was submitted that we are still not in agreement as to the clinical application of the bed rest principal A surprising number of institutions, it should be noted, do not employ rest as has been outlined in this discussion With the exception of those who are symptomatically ill, the patients are permitted considerable physical activity within and around the institutions premises As Fales observed 11 years ago, a few scheduled rest periods during the daytime are substituted for continuous bed rest The balance of the time witnesses the expenditure of variable amounts of muscular energy with its concomitant increases in pulmonary function Many patients in these institutions have never known a prolonged period of twenty-four hour daily bed rest as practiced in the institutions referred to above Young individuals with open cavities and recent progressive disease and even repeated hemoptyses are frequently administered pneumothorax and placed on a semi-ambulant schedule within a matter of days to a few short weeks thereafter Newly admitted cases in such sanatoria are often forced to walk through long corridors and up and down stairways to report for various examinations, treatments, and the like Having patients with active tuberculosis bathe themselves, make their own beds, shampoo their own heads, and even do some of their own personal laundry is an altogether false and too common method of holding down budgets in tax-supported institutions designed solely for the proper treatment, recovery and rehabilitation of the tuberculous

It is patently understandable why there is a paucity of medical reports on such methods from these institutions In view of this lack and in lieu of an adequate survey of all tuberculosis institutions in the nation in regard to this matter, the above assertions cannot be varified statistically Be that as it may, it is a matter of wide knowledge that these variations in the practical use of bed rest do in fact exist

A few short months ago, Dr Harry A Bray¹⁴ of the RayBrook Sanatorium published a critique of the results of strict bed rest as compared to partial rest in the treatment of patients with

minimal disease He quoted J Burns Amberson's article of 1937 in which the results of over 100 cases with early infiltrates treated for three or four months by strict bed rest are presented Amberson reported "lasting cure" in 90 per cent Bray asserts that this is in no way superior to the results at the Trudeau Sanatorium published in 1922 by Brown and Heise wherein strict bed rest was employed at no time He further points out that Brown and Heise's "minimal" cases had actually more extensive involvement than Amberson's "early infiltrates"

Bray bolsters his contention with a comparative statistical study of two groups of minimal cases treated at the Ray Brook Sanatorium between 1939 and 1942 These totaled 360 patients, 97 of whom had previously received an average of four months bed rest shortly before admission to Ray Brook Following admission to that sanatorium they were treated as the remaining 263 cases of the study had been handled from the first, that is, on partial rest only The two groups were otherwise reasonably comparable The classification of condition on discharge after an average duration of seven months treatment was as follows for the original strict bed rest group 71.1 per cent arrested, and for the partial rest group 79.8 per cent arrested, apparently arrested 12.4 per cent and 11.8 per cent respectively

Bray further explains in part "The asymptomatic patient with incipient disease on admission to Ray Brook is under close medical supervision for a period of two weeks, he rests in bed but is allowed bathroom privileges and goes to the dining room for his meals He then takes the cure on an open porch for several weeks after which he is placed on graduated exercise out-of-doors for specified periods ranging from five minutes to two hours daily, etc" If the foregoing results represent the average in minimal cases at Ray Brook, one cannot escape the conclusion that the modified rest program as practiced in that institution with minimal cases has been able to produce a percentage of recoveries comparable to the best of strict bed rest programs However, corroborative studies are needed before such conclusions are valid

Those who do not employ strict bed rest in the early months of treatment in routine cases with unstable lesions apparently conceive of the rest principal as only an adjuvant which assists in the building up of systemic vitality and resistance and which tends to restore reserve energy against the destructive potentialities of the tuberculous infection In a measure, they seemingly do not believe that the quieting of pulmonary function resulting from reasonably continuous twenty-four hour daily confinement to bed is an important or essential factor in therapy

Bray dismisses it with the curious observation that, "The only physical agent acting on the lung is tension resulting from expansion of the healthy parts of the lung " He offers certain observations which lead him to conclude that "the often expressed opinion that deep breathing may tear the wall of a tubercle is open to question " Be that as it may, there remains much reason to suspect that varying tensions of the lung caused by excessive breathing is not the only *modus operandi* in which exercise may mechanically affect the course of pulmonary tuberculosis

Coryllos¹⁵ postulated years ago that reduction in lung function by rest diminishes the oxygen supply to tuberculous tissues The resulting relative anoxia tends to inhibit the normal functions of the anaerobic mycobacterium of tubercle Whether this theory has anything to support it, there can be little doubt that tissue anoxic states augment the development of fibrosis Is there not, also, an increasing vascular stasis in pulmonary tuberculous tissues which have been permitted to remain as closely as possible to a functional resting state? Then, too, one must not overlook the effect on lymph flow in tuberculous tissue in the presence of exercise as compared to rest With increased function there is an accelerated rate of absorption of the waste products of the disease including the tuberculin fractions so important to allergy considerations Amberson¹⁶ contends that since caseation heals by encapsulation this process is aided by a lessened diffusion of toxins from the tuberculous tissues He felt that decreased lung movements occasioned by rest was important in this process

Similarly, Rich¹⁷ has stated that "it is not difficult to understand that the increased movement of the lungs associated with the greater respiratory activity during physical exertion can act mechanically to rupture partly caseous blood vessels and the necrotic margins of lesions, leading to hemorrhage and to the mechanical spreading of bacilli Caseous material, impregnated with tuberculo-protein, may be dislodged and transferred mechanically to other sites, leading to a spread of the infection and to the production of damaging hypersensitive reactions in previously normal tissue " He further states, "That over-exertion may cause an increased absorption of tuberculo-protein as indicated by the fact that signs and symptoms that result from physical overstrain in a tuberculous patient are ordinarily quite like those of a constitutional tuberculin reaction This familiar fact was stressed years ago by Patterson "

It is an elementary physiological principle so aptly stated by McLeod¹⁸ that, "The condition in which increased heart rate occurs with greatest certainty is muscular exercise " With increased heart rate occurs increased venous return and increased

pulmonary circulation It would seem reasonable that the latter state increases rather proportionately the chances for hematogenous dissemination of tubercle organisms There is similar reason to believe that the increased bronchial function which is part and parcel of increased respiratory activity can be a factor in a greater incidence of bronchogenic spreads of the disease This would be of greatest importance at times when resistance had temporarily ebbed

Admittedly, the precise manner in which a lessened intensity of pulmonary and cardio-respiratory function enhances healing of broncho-pulmonary and pleural tuberculous lesions has yet to be clearly demonstrated Nevertheless, there exists too great a mass of evidence in support of that belief to deny that healing is so favored It may be that the specific factor or factors are important in direct proportion to the extent of unstable pathologic areas in the lungs and elsewhere If so, this might account for Bray's apparent favorable results on partial rest with minimal cases, wherein the same methods of treatment are apparently damaging to patients with greater pulmonary involvement

CONCLUSION

This discussion lends itself to several conclusions It is apparent that the principal of twenty-four hour bed-rest for unstable cases of tuberculosis is not uniformly accepted and practiced in this country This is particularly regrettable at a time when promising research is developing in the direction of specific therapy Should an anti-biotic or some other agent be perfected which will act in a more or less specific manner against tuberculous lesions, it is highly probable that rest and resort to local collapse measures will still be required as the basic forms of treatment as they are at present Exudative lesions are the most likely type to respond to specific therapy When it is considered that much of the tuberculous pathology encountered clinically is predominantly of a mixed or productive type of lesion, it should be apparent that so-called "specific" will have definite limitations in therapy of this disease

It would seem, therefore, that before our therapeutic armamentarium becomes further implemented that this matter of the basic therapy, that is, general body rest, should be clarified and to some degree standardized Such clarification will depend on a renewed interest in the time-worn subject of rest It will require a considerable addition to the statistical evidence on treatment with partial bed rest as compared to complete bed rest There is also a continued need for an augmented knowledge of the effects of tuberculous disease on the physiology of the lungs, and the effects

of rest in contrast to exercise upon this altered physiology Adequate research in this field has been long overdue

SUMMARY

1) A brief historical review of the rest principal in the treatment of tuberculosis is given

2) It is postulated that there exists in the tuberculosis hospitals and sanatoria of the United States a wide divergence in the practical application of the basic principal of general body rest

3) The value of twenty-four hour daily bed rest as compared to partial bed rest for cases with unstable lesions is advocated Statistical evidence pro and con this point of view are discussed

4) Various theories relative to the manner in which general body rest mechanically effects pathologic lesions of the lungs are suggested

5) It is concluded that as we approach the age of "specific" or "partial specifics" in the therapy of tuberculosis, bed-rest, the basic form of treatment should be placed on a more uniform and scientifically developed basis A plea is made for a renewed interest in the subject

RESUMEN

1) Se presenta una breve revista histórica sobre el principio del descanso en el tratamiento de la tuberculosis

2) Se sostiene que en los hospitales y sanatorios para tuberculosos de los Estados Unidos existe una gran diferencia en la aplicación práctica del principio fundamental de descanso general para el cuerpo

3) Se aboga por el valor del descanso en cama por veinte y cuatro horas diarias, comparado con el descanso parcial en cama, para casos con lesiones inestables Se discuten los datos estadísticos tanto favorables como opuestos a este punto de vista

4) Se sugieren varias teorías relativas a la manera cómo el descanso general del cuerpo afecta mecánicamente las lesiones patológicas en los pulmones

5) Se concluye que ya que nos acercamos a la época de un "específico" o de "específicos parciales" en la terapia de la tuberculosis, el descanso en cama, tratamiento fundamental, debe situarse sobre una base más uniforme y científica Se ruega que se renueve el interés sobre este asunto

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Tuberculous Disease of the Trachea and Bronchi*

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Tracheobronchial tuberculosis is undoubtedly as old as tuberculosis itself. However it is only within comparatively recent times that our attention has been focused upon the fact that this manifestation of tuberculosis is of vital clinical importance to the Phthisiologist.

Pathologists have recognized the condition for some time, but clinically this complication has been accorded little consideration up until approximately the past decade. Eloesser⁵ in 1934 pioneered with an excellent discussion on stenotic lesions of the trachea and bronchi. Samson¹⁰ in 1936, Barnwell, Littig and Culp² in 1937, Warren, Hammond and Tuttle¹² in 1938 and others^{7, 9} through their several contributions have done much to stimulate interest and study in endobronchial tuberculosis.

The treatment of this condition has been widely discussed in the literature by numerous investigators including, Alexander and his coworkers,¹ Chamberlain and Gordon,³ Dolley and Jones,⁴ Tuttle and his coworkers,¹¹ and many others. All have contributed to our knowledge of the difficulties, complexities and successful methods available for the treatment of the tuberculous individual and the tuberculous infections of the bronchi and trachea.

Myerson⁷ states that "none of my patients have died because of the immediate effects of the bronchial lesions." He further declares that pneumothorax is superfluous, and that local treatment of the ulcer is of no value. Chamberlain³ states that endobronchial tuberculosis tends to run a self limited course. These statements are not clear but if they are meant to imply that an ulcerative endobronchial lesion is not a serious complication, experiences in this clinic cannot bear out those observations, unless it is possible that the authors had in mind only those nonulcerating, eroded or extrabronchial lesions which will be described more fully further on in this communication.

Tuberculous tracheobronchitis is not a distinct isolated disease entity, but is a distinct local manifestation of an infection that is essentially systemic in nature. The clinical conception and

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management of the disease, therefore, must be formulated in terms of the local lesion on the one hand, and of the disease in general, on the other

Chevalier Jackson, through the development of the bronchoscope, has provided the thoracologist with an instrument whereby the tracheobronchial tree may be observed and studied, the living pathological changes noted and appropriate treatment measures applied whenever possible. It is only within comparatively recent years that the bronchoscope has been used to any great extent in the treatment of tuberculous patients, therefore our knowledge concerning the tuberculous lesions of the tracheobronchial tree from the endoscopic standpoint is to a great extent either fragmentary or confused. Heretofore much emphasis has been directed against the management and treatment of the advanced and ulcerating and the stenotic lesions, with the result that considerable skepticism pervades the profession relative to the results of treatment and proper methods to be applied. When the disease has progressed to the point of advanced ulceration or stenosis, irreversible changes have taken place in the bronchial walls. Treatment must be energetic, and very frequently the methods employed must be of a permanent nature, such as thoracoplasty,

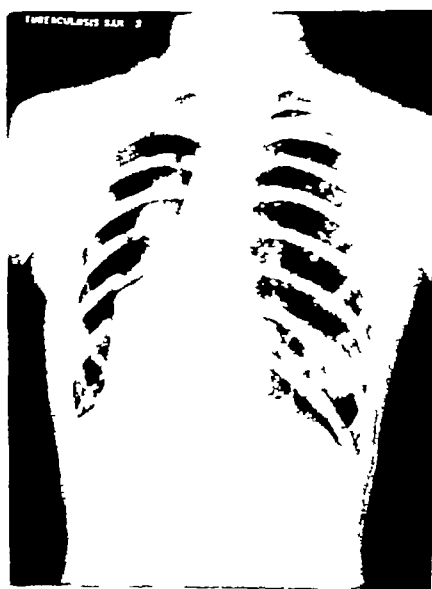


FIGURE 1 S.K. age 24 Typical roentgenogram showing atelectatic right lung occurring in a patient having all the classical symptoms of a stenotic endobronchial lesion but unrecognized for many months. The patient died as a result of an obstructing tracheal stenosis soon after this x-ray film was made



(c)

(b)

(a)

FIGURE 2 (a), J. S., age 26. Roentgenogram showing diffuse tuberculous involvement of right lung (June 15, 1945). FIGURE 2 (b), Same patient (July 20, 1945). Atelectasis of right lower lobe occurring suddenly, no collapse therapy having been attempted. A severe temperature elevation was present, but no symptoms with reference to the bronchi were elicited.—FIGURE 2 (c), Same patient (August 6, 1945). Following removal of large free mass of granulomatous tissue from the right lower lobe bronchus and discovery of large ulcerating and early stenosing lesion in the main stem bronchus near the carina.

lobectomy or pneumonectomy. It therefore becomes imperative, first, that we have a thorough knowledge of the underlying changes that ultimately lead to advanced stenotic changes in the bronchial walls, and secondly, that the endobronchial lesions be discovered as early as possible and treatment instituted.

The classical symptoms, particularly wheezing, are seldom if ever present in the early stages of the disease and generally are destined to appear only as the diameter of the lumen of the involved bronchus or trachea becomes narrowed (Fig I). Symptoms, however, when present may vary from the very mildest to the most severe cough, mild to exhausting in type, wheezing and dyspnoea, similarly slight to severe, are characteristic of advanced changes in the main stem bronchi or trachea. The average case, however, usually has a moderate productive cough, the sputum somewhat characteristically may be intermittantly positive and negative, but as the ulcerative process advances, a persistantly positive sputum becomes the rule. Occasional streaking and frank haemoptysis may likewise be encountered. In general, it may be stated that the symptoms will be proportional to the degree and character of the lesion, being most severe in stenotic and occluding types, and becoming most critical in the high grade strictures and occlusions of the trachea.

The roentgen findings and the extent of the endobronchial lesion usually show no definite correlation. Partial obstruction or definite limitation of the airway can be present without roentgen evidence of atelectasis (Figs IIa and IIc). On the other hand it is also possible that the x-ray will reveal evidence of an atelectasis of all or part of one lung without the patient being aware of any significant symptoms suggestive of tuberculous tracheo-bronchitis (Fig IIb).

The principal localizing symptoms and signs suggesting tracheo-bronchial tuberculosis, however, include the following:

1. Periodic variations in the character and in the amount of sputum. Although this feature may occur in the presence of non-obstructing lesions, it is considered more characteristic of the obstructed or partially obstructed bronchi.

2. Sputum, alternately positive and negative for acid fast bacilli, especially if such occurs at a time when the x-ray examinations show the parenchymal infection to be under control or actually show an absence of a parenchymal involvement.

3. Inspiratory and expiratory wheeze or stridor occurring in a patient with a positive sputum, or in a patient after sputum conversion. Although most common in tuberculous patients, a wheeze, or stridor may occur in the nontuberculous, but in any event a bronchoscopic investigation is indicated.

4 A difficulty in raising sputum particularly in the presence of a persistent cough that is difficult to control

5 Streaked sputum, or haemoptysis, occurring in the absence of definite active pulmonary tuberculosis (or other disease processes), or in the presence of an apparently controlled parenchymal disease, is suggestive and likewise should be investigated

6 Unexplained dyspnea, with or without an accompanying cyanosis This cyanosis if present is generally out of proportion to apparent existing disease

7 Roentgen evidence of unexplained lung density (atelectasis) occurring in the tuberculous patient, especially after the institution of collapse therapy, particularly artificial pneumothorax

These symptoms and signs are elicited principally, but not exclusively, in advanced cases of tracheobronchial tuberculosis They occur rarely, if at all, in the early cases Therefore as a bronchoscopic examination alone offers the only means for conclusive and undeniable diagnosis in the living individual, it is not amiss to suggest that only by the wide use of the bronchoscope in all collapse therapy patients will the maximum of good results be obtained in the treatment of this condition

Etiologically the tubercle bacillus is the causative organism, however, there are unquestionably multiple underlying, fundamental factors that singly, or in multiple, combine to determine the patient in whom the process will occur and the site at which the actual ulceration takes place Various theories have been advanced including the influence of an allergic diathesis as described by Oatway et al⁸ Certainly, why one tuberculous patient will develop a tuberculous endobronchitis or tracheitis, and another will not, still remains an unexplained question Our observations have convinced us of the existence of unexplained underlying influences and the fact that intrabronchial tuberculous bronchitis in all its phases is a continuous progressive process that may become arrested at any stage, spontaneously or through the intervention of therapeutic methods, or it may, on the other hand, progress to a strangulating stenosis with subsequent death, if the offending lobe or lung can not be removed or if the trachea itself becomes stenosed

The treatment of these lesions must follow the dictates of the specific lesion at hand It is therefore of utmost advantage that one have a thorough conception of the dynamics and peculiarities of the process encountered In view of this and on the basis of the observations and the studies, recently completed on 500 individual patients in our clinic, an attempt has been made to evolve a classification that will serve equally well from both the diagnostic and therapeutic standpoints This classification has been

described in another communication⁶ and is summarized as follows

Group I Extrabronchial lesions Lesions of this group originate as a result of the rupture of an underlying focus, a caseous lymph node or a tuberculous cavity into the bronchus or trachea

Group II Intrabronchial lesions This group represents all those lesions that have developed as a direct pathological process, in contrast to Group I wherein the bronchial involvement is decidedly indirect This group is further subdivided into five types, and each type for greater clarification is still further broken down into grade 1-2-3, except type V (see table 1)

TABLE 1
SUMMARY OF CLASSIFICATION

Group I Extrabronchial		
Group II Intrabronchial		
Type 1	Superficial Inflammatory Reaction	(Grade 1)
	to	
	Superficial Erosion	(Grade 2)
	Superficial Ulceration, Submucosal structures not invaded	(Grade 3)
Type 2	Submucosal Tissues Invaded, Little or no appreciable granulation tissue	(Grade 1)
	Redundant Tissues and Granulation Overgrowths	(Grade 2)
	Weakening of Walls	(Grade 3)
Type 3	Deeper Layers Invaded with Extensive Ulceration	(Grade 1)
	Fixation of Walls and Tissues	(Grade 2)
	Stenosis and Occlusion	(Grade 3)
Type 4	Ulcerating Process Resolved	
	Stenosis Present	
	Degree of Occlusion Expressed as	(Grade 1)
		(Grade 2)
		(Grade 3)
Type 5	Millary Implantations on Mucosa	

Type 1 The lesions in this category include those ranging from a superficial inflammatory reaction, the superficial erosion, to the superficial ulcerations that may extend to, but not into, the submucosal structures

Type 2 The lesions of this group include the ulcerating lesions that extend into the submucosal structures The area of ulceration may vary in size, the zone surrounding the ulcer area may show varying degrees of tissue redundancy Granulation overgrowth is common In the more advanced stages (grade 3) weak-

ening of the walls may be evident. A variation or distortion of the normal circumferential contour of the bronchial outline may be present but there is no actual reduction in the size of the bronchial lumen.

Type 3 Constitutes a category embracing those lesions wherein the process has progressed into the deeper layers, is associated with a fixation of structures and in the advanced phases there is a frank stenosing, narrowing, or occlusion of the bronchus or trachea.

Type 4 Represents that group of cases, generally few in number, in which the ulcerating and inflammatory process has resolved but in which the bronchus (or trachea) is definitely narrowed and stenotic.

Type 5 Embraces a rare group of cases. The lesions are characterized by miliary implantations in the mucosa of the bronchus or trachea. However, generalized miliary tuberculosis is not implied, but parenchymal involvement may or may not be present. It is suggested that this type may provide the background upon which the endobronchial tuberculous ulcers form when there is no accompanying parenchymal disease. Direct treatment of the lesion is endoscopic, and if the endoscopic treatment is to be maximally successful, the operator must be fully acquainted not only with the several endoscopic methods and with the peculiarities of tuberculous endobronchitis but also with the various collapse therapy procedures and their effect upon the maintenance of an adequate airway and drainage.

Group I Usually carries a very favorable prognosis with respect to the bronchus. Less energetic treatment is required than in many of those cases in **Group II**.

Group II Types 1 and 2 yield most readily to routine treatment methods and the percentage that advance to the more severe manifestations is exceedingly low, especially when the endoscopic treatment can be combined with some form of collapse therapy.

Type 3 Demands a much more energetic regimen, especially as regards to grade 2 and grade 3. Treatment in these cases is often times prolonged and difficult and not infrequently is discouraging. **Type 4** comprising those cases in whom the ulceration has healed, demands no active treatment in the less severe cases, while the moderately severe cases demand periodic dilatation of the stenotic ring, and the most severe cases usually come to some form of surgical intervention. The interval between treatments and the demand for surgical intervention varies with each individual case. It is doubted, however, that dilatation can ever be abandoned and the opinion is here ventured that sooner or later

every case that demands active dilatation will sometime come to operation for the eradication of the involved pulmonary segment or lung

Generally, the therapy of the endobronchial lesion specifically consists of repeated bronchoscopic treatments. Secretions are removed by the straight and curved tip aspirator. If the surface is simply inflamed, or is inflamed and boggy, some soothing application such as monochlorophenol with menthol, in oil, or gomenol may be applied. If the surface is eroded or ulcerated (type 2, Grade II and III), 5-10 per cent silver nitrate is applied topically. When the surface is covered over by an exudate, this is removed. Excess granulations are also removed in the same manner if possible, otherwise forceps are used. Twenty to thirty per cent silver nitrate is then likewise applied topically. In certain patients silver nitrate is not well tolerated, therefore in such instances the careful use of the actual cautery is recommended. Strictures are dilated as demanded by the individual case. Where miliary implantations represent the only manifestation present, active treatment is not required, except when there is a breakdown of any individual focus, then treatment follows the same pattern as just described.

The management of collapse therapy in the presence of endo-

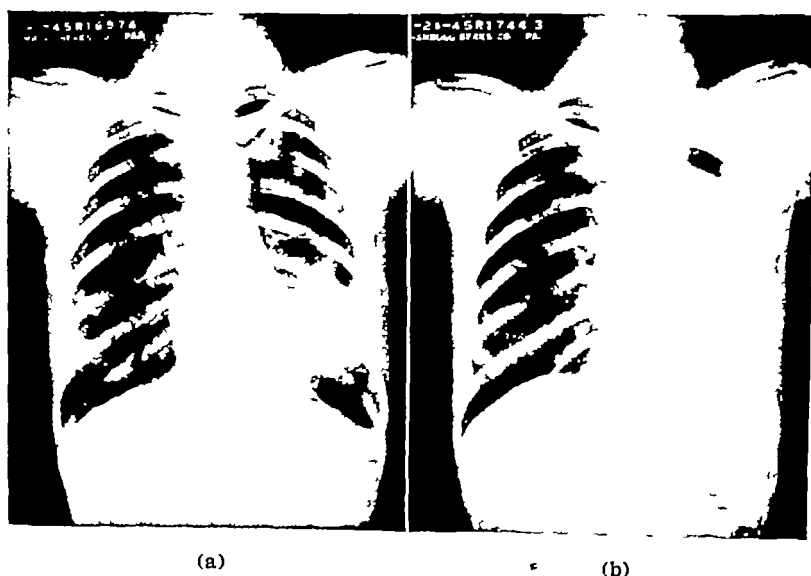


FIGURE 3 (a) A C age 38 Roentgenogram just following institution of artificial pneumothorax for cavernous pulmonary tuberculosis (June 5 1945)
FIGURE 3 (b) Same patient (September 25 1945) Showing atelectasis of left lung. Bronchoscopic examination revealed multiple ulcerations involving several of the smaller bronchi of the lower lobe and main upper lobe bronchus. The patient was asymptomatic with reference to the bronchi.

bronchial ulceration is oftentimes a matter demanding keen judgement. In the presence of types 1 and 2 of Group II, collapse therapy by any method indicated can be instituted with practically complete impunity from the bronchoscopic standpoint. Cases falling into the type 3 category, especially Grades II and III, often present vexing problems. Artificial pneumothorax is ill advised in many cases because of the danger that further stagnation of secretions is favored and an impending stenosis or occlusion may suddenly be precipitated (Fig III). In some cases, regional collapse methods such as thoracoplasty or extrapleural pneumothorax or plumbage may be instituted safely while an artificial intrapleural pneumothorax in those same cases would be contraindicated. In the more advanced stenosis as represented in types 3 Grade III, and type 4 Grades II and III, collapse therapy is hazardous and on the whole it appears that the removal of the lung (or lobe) may become the procedure of choice.

SUMMARY AND COMMENT

In summary, it should be emphasized that tuberculous endotracheobronchitis is but a local manifestation of a systemic type of disease. The development of the endobronchial phase of the disease is a gradual process starting first with small blood vessel dilatation. This is followed by a more pronounced inflammatory reaction with cellular infiltration of the tissues, accompanied by various degrees of edema and mucosal thickening. Thus an unhealthy mucosa favors stasis of secretions and by the interaction of a number of factors the mucosa becomes eroded, actual ulceration occurs and a process whereby a frank stenosis or occlusion of the bronchus or trachea, may develop. This sequence of events may occur in any of the bronchi or in the trachea, and may be interrupted and arrested at any stage, in the majority of cases. The prognosis and outcome will then be determined by the stage at which the process is arrested, provided that the disease of the lungs can be controlled.

This condition is similar to many others in that the goal of good and effectual treatment lies first, in the early discovery of the endobronchial lesions through the wide application of bronchoscopic methods, and secondly, in the judicious use of bronchoscopic and collapse therapy procedures.

RESUMEN Y COMENTARIO

En resumen, debe recalcarse que la endotráqueobronquitis tuberculosa es solamente una manifestación local de una enfermedad de tipo general. El desarrollo de la fase endobronquial de la enfermedad es un proceso paulatino que se inicia con la dila-

tación de los pequeños vasos sanguíneos. Sigue a esto una reacción inflamatoria más pronunciada con infiltración celular de los tejidos, acompañada de varios grados de edema y de engrosamiento de la mucosa. De este modo una mucosa anormal favorece el estancamiento de las secreciones y, debido a la acción recíproca de un número de factores, se desgasta la mucosa, ocurre una verdadera ulceración y puede desarrollarse un proceso que resulte finalmente en una franca estenosis u oclusión del bronquio o de la tráquea. Puede ocurrir esta serie de sucesos en cualquiera de los bronquios o en la tráquea, pero en la mayoría de los casos puede interrumpirse o estacionarse en cualquier etapa. Por consiguiente, lo que determina el pronóstico y el desenlace es la etapa en que se estaciona el proceso con tal de que se pueda dominar la enfermedad en los pulmones.

Se asemeja esta condición a muchas otras en las que el objeto del tratamiento adecuado y eficaz consiste, primero, en el descubrimiento temprano de las lesiones endobronquiales mediante la extensa aplicación de métodos broncoscópicos y, segundo, en el empleo juicioso de procedimientos broncoscópicos y de colapso-terapia.

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Tuberculosis Control in the Army*

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Fundamental principles in the control of tuberculosis, as applied by the U S Army in the war just concluded have been (1) exclusion of cases of tuberculosis at the time of induction, (2) early diagnosis and hospitalization of active cases in the Army in the course of normal medical care of troops, and (3) final check of all military personnel at the time of discharge, in order to return a tuberculosis-free population to civilian life

The exclusion of tuberculous cases was accomplished at induction stations by mass x-ray survey, with stereoscopic 4 x 5 films as standard Approximately 10,000,000 men accepted by the Army were examined by x-ray, after an average rejection rate of all men examined of approximately 1 per cent Since about 18,000,000 men were examined for the armed services, the total number rejected was about 180,000

Subsequent examinations within the Army were not routine until the time of separation from service However, many interim examinations were made, on the basis of chest symptoms, on application for officer candidate school or special military services, and in all cases where chest disease was suspected prior to dispatch on oversea service

The incidence of tuberculosis in the Army is reflected in the rate of admission to hospitals for observation for tuberculosis This was high in the early days of the war, because of the original acceptance of a considerable number of men without the x-ray examination, which was later required A rapid drop occurred in 1942, representing careful examination at induction, and the rate remained at approximately 1 per thousand men per year throughout the second half of 1942, and all of 1943, 1944 and most of 1945 Late in 1945 and throughout 1946 a definite rise occurred, coincident with a new mass survey for separation purposes

The discharge rate was lower, since only 60 per cent of the cases admitted for observation proved to be active tuberculosis requiring separation from service The discharge rate was thus

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approximately 0.6 per thousand men per year. The combined death rate for troops in service and men discharged from the Army, that is, World War II veterans on the rolls of the Veterans Administration, has been approximately 7 per 100,000 per year, as compared with a rate of approximately 50 for the same age group in the general population, a rate testifying to the efficiency of the induction station examinations.

Cases discovered on Army posts were sent to station hospitals and subsequently either discharged to the Veterans Administration directly or sent to Fitzsimons General Hospital for further treatment. When the overseas load became appreciable, men acquiring tuberculosis in foreign theaters were sent to Bruns General Hospital. Finally, with the load incident to separation service mass x-ray examination, the Army opened up a large tuberculosis section in Moore General Hospital.

The admission rate overseas was definitely less than that in the United States, except in recovered prisoners of war. The relatively low rate is explained by the fact that men were screened by several months of service and physical inspection prior to dispatch overseas. The higher rate in prisoners is attributed to the effects of hardship and exposure through contact with other prisoner groups with a higher rate of tuberculosis.

All personnel are required to have a physical examination, including a chest roentgenogram, at the time of separation from service. This has been accomplished at 25 regular separation centers and 150 temporary separation points. During the separation center examination approximately 1 man per thousand has been found to have tuberculosis or suspected tuberculosis requiring either treatment or observation. Cases discovered are sent to Army hospitals, and from there cases determined to be active are discharged to the Veterans Administration. At the present time the hospitals of the Veterans Administration are filled to maximum capacity, and the Army is holding about 3500 cases in its own three special tuberculosis hospitals.

SUMMARY

In conclusion it may be stated that the control measures as applied in the Army, with admitted imperfections due to rapidity of mobilization and military exigencies, have been effective in maintaining a population with a very low tuberculosis rate. There is every reason to believe that these measures will have a favorable effect on the whole trend of tuberculosis in this country, through the early discovery of cases, removal of sources of contagion, and the pattern of large scale observation set by the procedure followed.

CONCLUSION

En conclusión, se puede afirmar que las medidas de control aplicadas en el Ejército, aunque reconocidamente imperfectas debido a la rapidez de la movilización y a las exigencias militares, han sido eficaces en mantener una población con un índice de tuberculosis muy bajo. Se cree con mucha razón que estas medidas ejercerán un efecto favorable sobre el curso entero de la tuberculosis en este país, mediante el descubrimiento temprano de casos, el aislamiento de fuentes de contagio y el patrón de observación en grande escala que se estableció con el procedimiento empleado.

Pulmonary Cysts*

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Cystic disease of the lung, only a few years ago, was considered as a rare condition. The clinical features at first seemed bizarre and confusing, leading to mistaken diagnoses of heart disease, recurrent pneumonia, and asthma. With wider knowledge resulting from x-rays and bronchoscopy and the proved value of surgical treatment, with the well established fact that the cases are curable and not uncommon, there is a more favorable outlook and increasing interest in the subject. An important aspect, still confusing, is the question of etiology. Individual reports beginning in 1925¹ suggest that the largest number of cases are congenital in origin.

According to Klosk, Bernstein, and Parsonnet,² the development of congenital cysts possibly begins about the sixth month of embryonic life when branching and evagination of the lung buds become arrested, resulting in large solitary cysts. With arrest of growth, later in the course of development, multiple cysts result. Additional factors are influenced by failure of the bronchopulmonary segment to keep pace with the increased capacity of the fetal thorax, causing dilation of the involved bronchi. Congenital cysts, according to Gross,³ may be solitary, globular, pedunculated, or "ballooned-out." Cysts occur most frequently within the lung substance and are apt to be multiple, some are located in front or posterior to the lung root.

The pathology of congenital cysts shows mucus-secreting, ciliated, columnar, epithelium, resting on a layer of connective tissue. When the cysts communicate with the bronchus, it is sometimes difficult to demonstrate the exact structural relationship. In some cases the lung parenchyma is replaced with large cavities and underlying cystic degeneration varying in degree from multi-locular to uni-locular cysts, occupying one or both lungs (Klosk, Bernstein, and Parsonnet).²

In the acquired form there is a possible relationship to chronic bronchitis, bronchiectasis, peribronchitis, pulmonary fibrosis, em-

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physema, bronchial asthma, repeated bouts of hard paroxysmal coughing, and such influences as loud talking and shouting in the presence of some underlying weakness of the part Fundamentally, the acquired pulmonary cysts result, or are, associated with an inflammatory process According to Gross,³ cicatricial tissue surrounding bronchi, bronchioles, and alveolar ducts will produce obstructive emphysema of a bullous type so that cavernous spaces will develop in the pulmonary parenchyma In the early stage it is impossible to determine whether the cysts are of congenital origin with superimposed infection or whether the phenomenon is the product of pneumonitis or some other pulmonary condition In the late stage, as pointed out by Gross,³ the postinfectious origin of the cysts will become apparent only if a history of an acute infection is obtainable or the specimen is studied histologically With cicatricial change of the bronchial mucous membrane there may be gradual obstruction and, distally, dilatation resulting in extension and thinning of the terminal bronchioles Actually, the cyst may show the combined development of ruptured alveoli, forward development and spreading of a bronchus in which the columnar epithelium is preserved and carried forward into the cavity as an inner lining It is possible in certain cases that an embryological defect is also a factor, combined with the mechanical influences of bronchial obstruction

The possible mechanism of combined formation of the congenital and acquired types was suggested in a pathological specimen examined with Dr E Suhrawardy⁴ at the Indian General Hospital near Asensol, India Tracing the pathology of the wall, a curious thinning out of the columnar epithelium was noted, a part of the wall being composed entirely of fibrous tissue It appeared that bronchial extension and dilatation had been extended coincidentally and that the wall of fibrosis was formed in a compensatory development thus completing a cyst-cavity

According to Wood,⁵ there is no syndrome on which a definite clinical diagnosis of congenital or acquired cysts may be based Attacks of dyspnea with cyanosis, particularly in infancy and childhood, have aroused suspicion and the subsequent diagnosis In older people progressive dyspnea with or without respiratory infection has been suggestive Illustrating the difficulties in diagnosis is the fact that congenital cysts have been found in adults with no previous history of manifestations in childhood Evidently, the severity of the symptoms is dependent upon (1) the extent of destruction of the parenchymal tissues and (2) changes in the intrathoracic pressure due to cysts with an imperfect bronchial communication In the latter cases, the attacks of

severe dyspnea and cyanosis, may closely simulate spontaneous pneumothorax and with infection result in chronic empyema. Hemoptysis has been reported by Churchill⁶ and others. Bouts of "pneumonitis" and "recurrent pneumonia" are suggestive since it is recognized that transient pulmonary phenomena can be due to blockage and extension of infection from the affected part.

The physical examination may show areas of increased hyperresonance and altered breath sounds and occasionally whispered pectoriloquy. Elevated temperature and expectoration suggest associated infection. Displacement of the heart and trachea to the contralateral side is not infrequent in large tension cysts. According to Willauer,⁷ some cases closely resemble empyema due to infection *per se* and their failure to respond to treatment may be the first clue of the presence of a cyst.

Roentgenologically, the cystic spaces are well defined and are traversed by linear strands. When the cavities are "ballooned-out" by highly positive intraluminary pressure, the mediastinum and its contents are displaced to the opposite side. The translucency of the shadow may resemble that of tension pneumothorax. A feature of typical cases is the thin-walled cavity. While fluid levels are not uncommon, evacuation may be impossible and likewise the introduction of iodized oil into the cavities. With massive collections of fluid, the shadow may be dense and resemble consolidation. In certain instances the lung will show the mottled and increased density of pulmonary infection and the associated cystic areas.

Interest in the frequency of pulmonary cysts in adults, presumably of the acquired type, was aroused in studies of Indian workmen living in Bengal Province, India. The following cases are reported to illustrate the apparent influence of continued exposure to dampness, dust, and intercurrent respiratory infections and the effects of hard labor in the development or aggravation of acquired pulmonary cysts.

Attention was attracted to three men, primarily because they presented the appearance of far advanced pulmonary tuberculosis, with loss of weight, cough, expectoration, elevation of temperature, rapid pulse, and fatigue. It was customary for them to sleep on the ground, wear light clothes, exposure to wind, rain and dampness was common. As an example of the symptoms, one workman had a paroxysmal cough with dyspnea and glarey, mucoid sputum. The attacks were marked during the night and early morning hours, as the temperature lowered and dampness developed. His chest was hyperresonant over the middle third, with extremely distant breath sounds. In each case the x-ray films showed a large thin-walled cavity with mottled shadows

at the base of the lung, there was no evidence of pulmonary fibrosis or emphysema. Two other laborers working in a "surface well," suffered repeated attacks of coughing, dyspnea, and had glary expectoration. The symptoms were exaggerated as they climbed from the bottom of the excavation along a path approximately 100 feet in length with a grade of about 20 degrees. The physical examinations showed a decrease of respiratory movements on the affected side with exaggerated breath sounds and localized coarse, musical rales. In the roentgenograms of the chest there were signs of emphysema and single cavities, "balloon" in type, with remarkably thin walls. Repeated sputum tests were negative for tuberculosis. Bronchoscopy and iodized oil were not available for direct inspection or mapping of the bronchial tree.

Another patient was seen in a Government Hospital near Burdwan, India. The history indicated that there had been several attacks of pneumonia followed by cough, dyspnea, expectoration and empyema with drainage through the chest wall. The x-ray film showed an enormous, thin-walled cavity communicating with the sinus of the chest wall. The sputum and pus showed no tubercle bacilli or evidences of hydatid cyst. The presence of the cavity and the mucoid pus supported the diagnosis of cystic disease.

The following cases studied and treated in the Jefferson Hospital illustrate the clinical features and complications of cystic disease of the lungs.

Case 1 M F, a married woman, 33 years of age, gave a history of shortness of breath since childhood and the occurrence of a spontaneous pneumothorax about four months before entry to the Hospital. The existence of some condition other than spontaneous pneumothorax was suspected by Dr. Peter Theodos because of the intermittent and slowly rising "intrapleural pressure." A thoroscopic examination by Dr. George Willauer showed a cystic wall and a partial obstruction of the bronchus which permitted air to enter and be trapped in the cyst, thus simulating pneumothorax. Lobectomy was performed and the specimen showed the features of acquired cyst of the lung.

Case 2 E L, male, age 14, was referred for the treatment of loculated empyema with long continued attacks of violent coughing and fever. The x-rays showed small cavities and fluid at various levels of the lung. The bronchoscopic examination was essentially normal. In the specimen of the lung removed by lobectomy, there were the typical features of acquired cyst of the lung.

Case 3 E M, a married woman, 51 years of age, had experienced for 12 years curious manifestations in the right side of her chest, sometimes associated with cough and "gurgling" especially on changing positions. Tuberculosis had been suspected. A large thin-walled cavity was seen in the x-ray studies (Dr. Paul Swenson). Bronchoscopy showed no abnormality of the bronchi. A large cyst of the lung was removed by lobectomy. The histological studies showed the features of acquired cystic disease due to extension and dilatation of the bronchi.

CONCLUSIONS

1) It is suggested that cystic disease of the lung should be considered in patients with nontuberculous pulmonary cavities and bizarre pulmonary symptoms

2) Recurrent attacks of persistent hard cough, glarey expectoration and dyspnea should arouse suspicion

3) The complications of pulmonary cysts are varied and may completely mask the underlying condition

4) Etiology may be indefinite, the occurrence of repeated respiratory infections associated with the trauma of cough and strenuous effort may be contributing factors

5) Cases observed in India unproved as to the type of cyst, are included in the present report to indicate the possible influences of exposure, pulmonary infection and work in the development of cysts

CONCLUSIONES

1) Se sugiere que se considere la enfermedad quística del pulmón en pacientes con cavernas pulmonares no tuberculosas que presentan síntomas pulmonares poco comunes

2) Accesos periódicos de tos fuerte y persistente, expectoración viscosa y disnea, deben despertar sospechas

3) Son variadas las complicaciones de los quistes pulmonares y pueden encubrir por completo la condición subyacente

4) La etiología puede ser vaga, repetidas infecciones respiratorias asociadas con el traumatismo de la tos y de esfuerzos estrenuos, pueden ser factores contribuyentes

5) En el presente informe se incluyen casos observados en India de quistes de tipo indeterminado, para indicar las posibles influencias de la exposición, la infección pulmonar y el trabajo en el desarrollo de los quistes

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Early Clinical Features of Bronchogenic Carcinoma. Illustrative Cases*

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Only three or four decades ago, the number of cases of bronchogenic carcinoma in which the diagnosis was established or even suspected during life was extremely small. As adequate facilities for diagnosis have become more available, the proportion of cases proven in all stages of the disease has shown a progressive increase. For example, a recent analysis of 310 cases of bronchogenic carcinoma seen at the Chevalier Jackson Bronchoscopic Clinic,¹ showed that histologic proof of the diagnosis was obtained during life, bronchoscopically or otherwise, in about 97 per cent of cases. During the same period there were observed an additional 37 cases in which the clinical diagnosis of bronchogenic carcinoma appeared highly probable, although conclusively diagnostic tissue was not obtained.

Statistics with regard to operability, however, leave much to be desired. Of a series of 269 proven cases seen at the Chevalier Jackson Bronchoscopic Clinic from January 1935 to December 1944 inclusive, only 30 (12.9 per cent) were found operable. The fact that the majority of bronchogenic carcinomas have reached an inoperable stage before the diagnosis is established is corroborated by the experience of most thoracic surgeons.

A survey of the case-records in the above-mentioned series indicates that many of the delays in diagnosis could have been avoided if the indications for roentgen examination, bronchoscopy and other diagnostic procedures had been properly appreciated. The early manifestations of a bronchogenic carcinoma may easily be confused with those of a variety of other common chest diseases, and for this reason a consideration of early clinical features seems appropriate.

The early manifestations of a bronchial carcinoma depend to a large extent on its point of origin, so that an arbitrary classification based on location is of more practical value for clinical

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study than one based on the inherent pathological characteristics of the tumor itself. Thus separate consideration might be given those tumors which arise in a main or lobar bronchus, those which arise in a segmental bronchus, and those which arise peripherally (Fig 1). It is believed that somewhat more than 50 per cent of the carcinomas arise in a main, stem or lobar bronchus, a much smaller number appear to have originated in one of the segmental bronchi, and about 25 per cent of the lesions are thought to arise peripherally.

Carcinoma of the Larger Bronchi (Numbers 1 and 2 in Fig 1). The earliest symptom of a lesion arising in one of the larger bronchi is one of bronchial irritation, namely, a chronic cough, usually nonproductive. If there has been a pre-existing cough, some change in its character or frequency may be noted. After a variable interval, other symptoms arise because of an increasing degree of bronchial obstruction which interferes with air exchange.

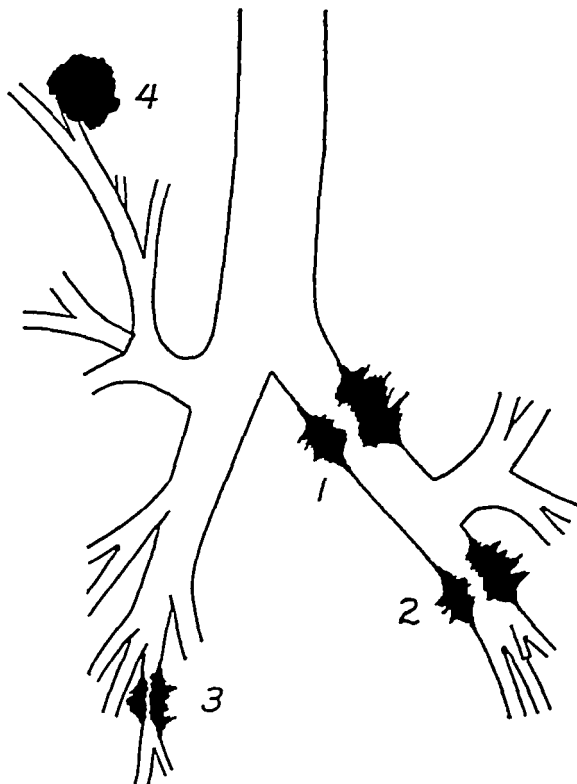


FIGURE 1 Bronchogenic Carcinoma. Arbitrary Classification Based on Location. The early clinical manifestations, including roentgen findings depend on the point of origin. Main bronchus (1), lobar bronchus (2), segmental bronchus (3), or small peripheral bronchus (4).



FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 2 Negative roentgenogram of a 52 year old male in whom an early carcinoma (squamous cell) was found on bronchoscopy—FIGURE 3 Male, 47 years old, with symptoms and roentgen findings suggestive of bronchiectasis, carcinoma of the right main bronchus (squamous cell) proven by bronchoscopic biopsy—FIGURE 4 Male, 58 years old, under treatment for "asthma." Bronchoscopy showed early carcinoma of right main bronchus

or bronchial drainage or both. The lesser degrees of bronchial obstruction may give rise to a wheeze, which can often be localized by the patient to one side or the other, and is more or less continuous until the obstruction becomes nearly complete.

Impairment of the normal mechanisms of bronchial drainage results in secondary infection, which may at first resemble one of the common acute lower respiratory infections, so that patients at this stage of the disease are often treated for various types of pneumonia, bronchitis, "flu," "grippe," common cold, pleurisy and the like. Often such acute episodes appear to subside under medical treatment, but there remains a persistent cough, often productive of purulent sputum. Blood streaking or hemoptysis is prone to occur during the early phase of the disease in cases where the lesion is in one of the larger bronchi.

An incipient carcinoma in a main or lobar bronchus gives rise to no abnormal physical findings. As is now generally recognized, abnormal physical signs as well as roentgen findings, when they first appear, are likely to be those of some degree of bronchial obstruction, the presence of tumor being suspected only because of its effect on air exchange and bronchial drainage. Accordingly, the physical examination may show, as the first manifestation, nothing more than diminished respiratory excursion of the corresponding hemithorax. Thomas McCrae,² felt that this was the most constant physical finding in early cases. Associated with this may be some diminution in breath and voice sounds, transient or persistent moist rales may be heard.

As appreciable degrees of bronchial obstruction develop, the asthmatoïd wheeze described by Chevalier Jackson,³ best heard at the open mouth near the end of a forcible expiration, may be heard, and auscultation may show a unilateral wheeze. Further increase in the degree of bronchial obstruction is accompanied by an interval when the check-valve mechanism gives rise to signs of obstructive emphysema. This period is a transitory one, the obstruction in cases of malignant tumor soon become complete, so that the signs of emphysema are soon succeeded by those of atelectasis. Physical signs which change from day to day characterize the period of increasing bronchial obstruction.

As would be expected, an incipient lesion in a main or lobar bronchus may give rise to no positive roentgen findings. This point is illustrated by the following case.

Case I. G. A., male, 52 years, a physician, had noted a chronic cough, productive of small amounts of mucoid sputum, for about 5 months. Blood-streaking had been noted on several occasions although there had been no actual hemoptysis. The physical examination showed no abnormal chest findings. The roentgen examination of the chest, including

fluoroscopy, was considered entirely negative (Fig II) However, the bronchoscopy showed a nodular area along the wall of the left main bronchus which proved, on biopsy, to be a squamous cell carcinoma

Although in the series of 310 cases recently reviewed there were only 6 cases in which the chest films were thought to be essentially negative, this number might have been much larger if there had been less delay between the onset of symptoms and the first x-ray examination This case illustrates the fact that symptoms alone may be sufficient indication for bronchoscopy, even though the x-ray film may show little or no abnormality Unfortunately, the number of cases in which bronchoscopy is made available at this early stage is distressingly small, for there is a general tendency to defer such an examination if the x-ray shows little or no abnormality There is but little physical disability at this stage of the disease, so that it is not unusual for both the patient and his physician to minimize the importance of the symptoms However, the very lesions which show no early roentgen changes are those which arise in the larger bronchi, and are therefore accessible bronchoscopically almost in their incipency

Case II J D, male, 47 years, complained of productive cough of 9 months duration following what had appeared to be an atypical pneumonia, the sputum had been blood-streaked at times Auscultation showed numerous coarse moist rales at the right base, and the x-ray (Fig III) demonstrated in the right lower lobe region, abnormal stringy density of the type often associated with bronchiectasis However, the bronchoscopy showed a carcinoma of the right bronchus, inoperable because of its proximity to the carina

In this case, there had been a clinical diagnosis of bronchiectasis, and the referring physician was inclined to feel that the rather mild symptoms, apparently adequately explained by the roentgen findings, would scarcely call for a diagnostic bronchoscopy The above case well illustrates the fact that persistence of chest symptoms following what has seemed to be one of the common acute lower respiratory infections should call for further investigation, certainly by roentgen examination and frequently by bronchoscopy

Case III G L, male, 58 years, had been treated by his family physician for asthma and hay fever for over 15 years Recently, however, the wheezing had been more or less continuous, with paroxysmal exacerbations only partially relieved by the usual medications, there had been increasing dyspnea, with increased cough and one episode of blood-streaking The x-ray (Fig IV) showed fibrosis and emphysema, with abnormal mottled and stringy density in the right lower lung field, adjacent to the heart border These changes were thought to be compatible with a history of long-standing bronchial asthma, but the bronchoscopy showed that there was in addition, a relatively early carcinoma of the right main bronchus

The above case undoubtedly was, for many years, one of "bronchial asthma," for there was a long history of paroxysmal attacks relieved by administration of adrenalin, however, the occurrence of a wheeze which was more or less continuous indicated that there might be a partially obstructive lesion in one of the larger bronchi. Even in cases where the clinical findings suggest bronchial asthma of the common type, a diagnostic bronchoscopy may frequently prove to be worthwhile, apart from the finding of previously unsuspected lesions.

Case IV V R, male, 46 years, had noted a chronic cough, productive of small amounts of purulent sputum, for about 6 months. The roentgen examination (Fig V), showed some abnormal density which, by its character and distribution, rather suggested the possibility of bronchiectasis, and the patient had been referred with a clinical diagnosis of bronchiectasis with a request for bronchography. However, it was decided that a bronchoscopy should be done first, as is the custom, and the right lower lobe bronchus was found to be narrowed by a nodular lesion which proved on biopsy to be a squamous cell carcinoma of rather low grade. There were no evidences of inoperability, a pneumonectomy was performed, and the patient, now about thirty months after operation, has no symptoms or findings suggestive of recurrence or metastasis.

It is important in cases of this sort not to be satisfied with bronchography alone. An early lesion in one of the larger bronchi may, if only partially obstructive, not interfere with complete filling of the bronchial tree. Although Farinas⁴ has felt that bronchography has considerable importance in the diagnosis of tumors of the larger bronchi, and has even devised a classifica-



FIGURE 5 Male 46 years old referred for bronchography with clinical diagnosis of bronchiectasis. Early squamous cell carcinoma of right lower lobe bronchus proven by bronchoscopic biopsy. Pneumonectomy.

tion based on the bronchographic appearance, dependence cannot be placed on this procedure in ruling out an early neoplasm of one of the larger bronchi, frequently the walls of this portion of the bronchial tree are not completely coated with lipiodol, in spite of a technic which is otherwise satisfactory

Case V M K, male, 48 years, complained of chronic cough, productive of purulent sputum, at times quite foul, these symptoms had appeared to follow a "pneumonia" 6 months previously. In the interval there had been intermittent fever, sweats, and considerable weight loss, the patient was referred with a clinical diagnosis of "suppurative pneumonitis." The x-ray findings are shown in Fig VI. In this case, as in many others which have been treated under a diagnosis of "unresolved pneumonia," the underlying cause was a partially obstructive bronchial lesion. The carcinoma in this instance was in the right lower lobe bronchus.

Cases II, III, IV and V illustrate the fact that changes which may appear to be on a basis of chronic non-specific inflammatory disease may simply represent impairment of bronchial drainage due to an early phase of bronchial obstruction. In none of these cases was the tumor itself evident on the conventional films, and in none of them had sufficient obstruction occurred to produce interference with air exchange (i.e. obstructive emphysema or atelectasis). In such cases an important diagnostic point is that the roentgen changes are lobar or unilateral, such findings nearly always call for a diagnostic bronchoscopy.

Case VI A A, female, 38 years, complained of cough, productive of small amounts of mucoid sputum, of 2½ years duration, with continuous wheezing for the previous several months. Several rather large hemoptyses had occurred recently. The physical examination showed hyper-

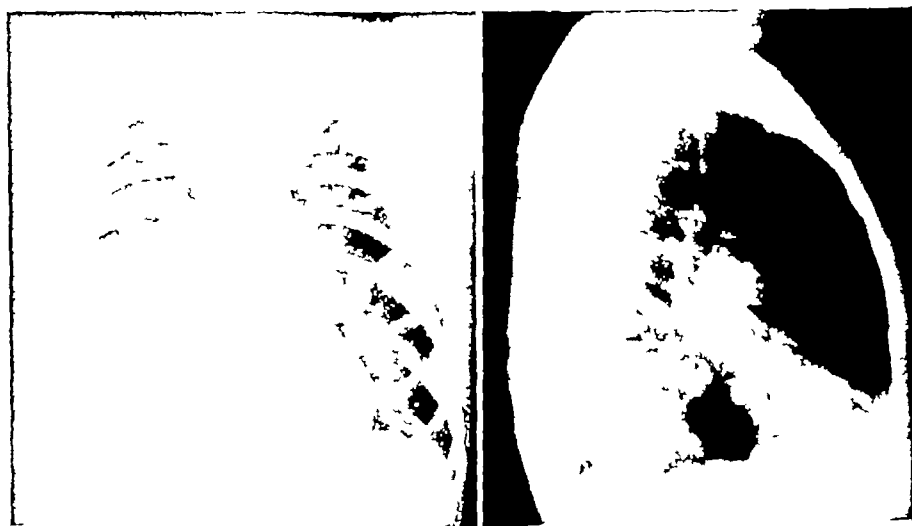


FIGURE 6 Male, 48 years old "Suppurative pneumonitis" secondary to squamous cell carcinoma of right lower lobe bronchus

resonance and diminished breath sounds throughout the entire left chest and the roentgen examination (Fig VII), showed a characteristic picture of obstructive emphysema of the entire left lung. On bronchoscopy, a nodular lesion almost completely occluding the left bronchus was found and biopsy showed adenocarcinoma, grade II.

The phenomenon of obstructive emphysema is observed most dramatically on fluoroscopy, where, if the obstructive lesion is in a main bronchus, the emphysematous lung contrasts strikingly with the normally emptying lung on expiration. In this case, the left lung appeared hyperaerated even at the height of in-



FIGURE 7 Female 38 years old Obstructive emphysema of left lung due to adenocarcinoma of left main bronchus



FIGURE 8 Male 67 years old. Atelectasis of right upper lobe, squamous cell carcinoma of right upper lobe bronchus, proven by bronchoscopic biopsy

spiration (Fig VIIa) On expiration (Fig VIIb), the right lung emptied normally, the left lung remained distended and the left leaf of the diaphragm remained depressed, the mediastinum swinging far to the right

Case VII C C, male, 67 years, a physician, presented a history of non-productive cough of many years duration Recently the cough had increased in frequency and hemoptysis had been noted for approximately 3 months The roentgen examination (Fig VIII) showed a complete atelectasis of the right upper lobe, with numerous radiolucent areas suggesting parenchymal destruction Tissue obtained just within the right upper lobe orifice at the time of bronchoscopy showed squamous cell carcinoma, grade III

Cases VI and VII illustrate two of the more commonly recognized roentgen evidences of an obstructive bronchial lesion, in cases of this sort the indications for bronchoscopy are quite obvious and, since the lesions giving rise to emphysema or atelectasis of a lobe or an entire lung are in the larger bronchi, biopsy is feasible in a high proportion of cases, even when the lesion originated in an upper lobe bronchus

The impression is occasionally encountered that bronchoscopy will be of less value in upper lobe lesions Table I presents data regarding the incidence of positive bronchoscopic biopsy in relation to probable origin This series of patients seen at the Chevalier Jackson Bronchoscopic Clinic included all those in whom the diagnosis of bronchogenic carcinoma was ultimately proven,

TABLE I
BRONCHOGENIC CARCINOMA — 310 PROVEN CASES
Incidence of Positive Bronchoscopic Biopsy in Relation
to Probable Origin

	CASES	POSITIVE BIOPSY	
		No	Per cent
Right upper lobe	63	37	58.7
Right middle lobe	7	4	57.0
Right lower lobe	70	62	88.6
Right main or stem bronchus	36	36	100.0
Right lung — origin uncertain	13	3	23.1
Left upper lobe	40	13	32.6
Left lower lobe	44	38	86.4
Left main bronchus	25	25	100.0
Left lung — origin uncertain	9	1	11.1
Bilateral — side of origin uncertain	2	0	0.0

regardless of the method by which the diagnosis was finally established. The incidence of positive bronchoscopic biopsy is somewhat less in the upper lobe lesions, particularly those in the left upper lobe, but there is sufficient indication for bronchoscopy in many upper lobe cases, particularly those in which the x-ray films suggest that the tumor is near the hilus, or give evidence of obstruction of the lobar bronchus. Furthermore, as C L Jackson⁵ has emphasized on many occasions, bronchoscopy should be done not only with the expectancy of obtaining tissue for biopsy, but to rule out involvement of the main bronchus in its proximal portion and to evaluate any indirect evidence of mediastinal involvement such as compression or fixation of the lower trachea or main bronchus, or widening or fixation of the carina.

Not all of the tumors which are thought to arise in the larger bronchi give rise to early signs of obstruction. The stage of the disease at which the phenomena of obstructive emphysema or atelectasis occur will depend not only on the size of the bronchus involved, but also on the ratio between the endobronchial and extrabronchial portions of the tumor. Thus, in some of the so-called "hilar" lesions, such as that shown in Fig IX, the infiltrating extrabronchial portion apparently has progressed much more rapidly than the endobronchial portion. In most of these cases, infiltration of the mediastinum has already occurred before the diagnosis is established, because the patient is apparently not ill enough to require special studies or even roentgen examination prior to the occurrence of those manifestations depending on obstruction. In the case illustrated in Fig IX, the compression



FIGURE 9 'Hilar' bronchogenic carcinoma (squamous cell) with mediastinal invasion.

and displacement of the esophagus and the presence of phrenic nerve paralysis (paradoxical motion of the diaphragm as seen fluoroscopically) indicated an inoperable situation

The patient whose roentgen films are represented in Fig X illustrates another of the rather common manifestations of bronchial obstruction, namely pulmonary abscess. The frequency with which this type of pulmonary suppuration is associated with a bronchial lesion is such that diagnostic bronchoscopy appears indicated in any case where cavitation is not clearly tuberculous in origin, a point which has been thoroughly discussed by C L Jackson⁶. A relatively early tumor may be responsible for extensive secondary changes such as those shown in Fig X, in this case, the carcinoma of the right lower lobe bronchus was quite small, and the part of the lung in which the large abscess had occurred showed no evidence of tumor infiltration.

Carcinoma Arising in a Segmental Bronchus (No 3 in Fig I)
The cases which may be included under this heading constitute an important, though not a large group. Here the diagnosis can be made early, though with somewhat greater difficulty than in cases where larger bronchi are involved, and the incidence of operability is rather high. A lesion arising here will obstruct the segmental bronchus almost at the start, for this reason the symptoms frequently have their onset in a more or less acute febrile illness consequent on segmental obstruction and secondary infection. Although the physical signs may not be striking, an x-ray film made at this time will show changes limited to a single bronchopulmonary segment, there will be a wedge-shaped area



FIGURE 10 Large pulmonary abscess secondary to carcinoma of right lower lobe bronchus

of density extending peripherally from the hilus, and the involved segment can usually be identified in the lateral view

Case VIII J B, male, 50 years, gave a history of persistent symptoms (cough, purulent expectoration and low-grade fever) following what had appeared to be a pneumonia, and the x-ray films (Fig XI, a and b) made on his admission to the hospital showed changes which appear limited to the posterior basal segment of the right lower lobe. The first bronchoscopy in this case showed nothing except for purulent secretion and mucosal congestion. The iodized oil instilled for bronchography, however, showed occlusion of the bronchus of the posterior basal segment a short distance from its point of origin (Fig XI c). This is just beyond the range of visibility in the ordinary bronchoscopic examination, but another bronchoscopy was done, and by use of a small forceps introduced into the posterior basal segmental bronchus, which can be quite easily identified, tissue was obtained which showed squamous cell carcinoma, grade II. This proved to be an operable case and now, after about 3½ years, there is no evidence of recurrence or metastasis.

Roentgen evidence of a segmental atelectasis is as strongly suggestive of bronchial occlusion as is a lobar atelectasis, if this fact is recognized and if every effort is made to obtain material for histologic diagnosis, many of these lesions can be proven while still operable. The relative constancy of the segmental bronchial anatomy, a subject recently reviewed by Jackson,⁷ facilitates a correlation of roentgen findings with the bronchoscopic approach in such cases, careful study of the postero-anterior and lateral roentgenograms before and after instillation of iodized oil will frequently show which of the segmental bronchi deserve particular attention at the time of bronchoscopy. In cases where actual tissue cannot be obtained from a segmental bronchus, examination of secretions obtained from the segmental bronchus, according to the technic of Herbut and Clerf,⁸ would seem to be a particularly advantageous method.

A number of British authors, Barrett,⁹ Dudgeon,¹⁰ Gowar¹¹ and others have reported a high percentage of accuracy in cases diagnosed by examination of sputum for malignant cells. Bence¹² has described the use of bronchial lavage in obtaining material for microscopic examination, and Perez-Ara¹³ has described the use of a special "broncho-catheter" introduced under fluoroscopic guidance in obtaining material from segmental bronchi.

The following two cases illustrate the difficulties of differential diagnosis in instances where the lesion arises in a segmental bronchus.

Case IX R S, male, 27 years, complained of slightly productive cough of several weeks duration with blood-streaking on two occasions. Tuberculosis was considered the most likely possibility in view of the age and roentgen findings (Fig XII). The bronchoscopy was negative and pneu-



FIGURE 11 Male, 50 years old Atelectasis of posterior basal segment of the right lower lobe Biopsy obtained bronchoscopically from posterior basal segmental bronchus showed squamous cell carcinoma Pneumonectomy

mothorax was given, although sputa had been consistently negative. This proved to be a case of undifferentiated carcinoma, presumably arising in the segmental bronchus, ultimately proven after an interval of six months by microscopic examination of particles of tissue found in the sputum.

Case X J C, male 42 years, complained of chronic cough, usually nonproductive, with one recent hemoptysis. Serial roentgen examinations (Fig XIII) showed the development of an atelectatic segment in the right upper lobe. Pneumothorax had been given previously on a



FIGURE 12 Male 27 years old. Symptoms and roentgen findings suggestive of pulmonary tuberculosis. Undifferentiated carcinoma arising in segmental bronchus in left upper lobe.

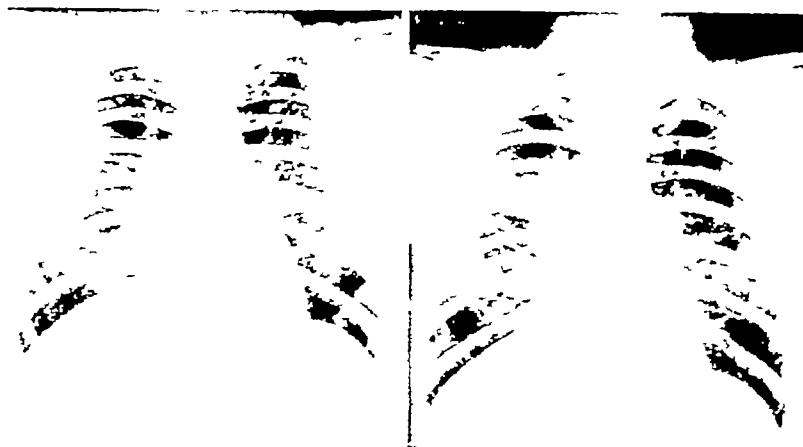


FIGURE 13 Male 42 years old who had been in a sanatorium for tuberculosis for several months. Squamous cell carcinoma arising in segmental bronchus in right upper lobe.

presumptive diagnosis of tuberculosis without confirmation by positive sputum. This patient was referred for bronchoscopy eleven months after the onset of symptoms, and a carcinoma was found extending to within a few millimeters of the right upper lobe bronchial orifice. A pneumonectomy was done, but recurrence was found in the bronchial stump after 10½ months. Here the delay of many months between the onset of symptoms and the proving of the diagnosis may well have been responsible for the fact that this patient could not be cured.

Carcinoma Arising from Peripheral Bronchi (No. 4 in Fig. 1)
The bronchogenic carcinomas which arise peripherally might quite appropriately be called "silent tumors," for they frequently attain

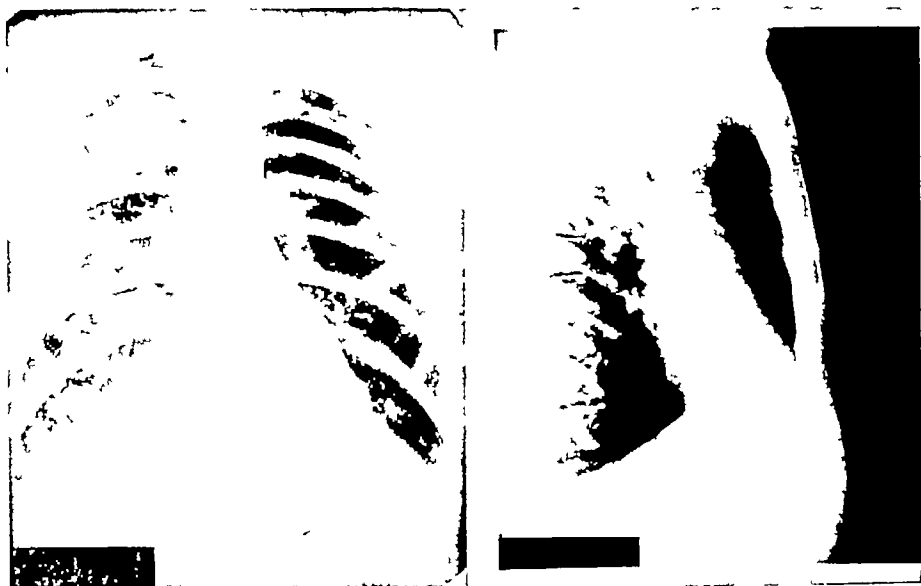


FIGURE 14 Male, 54 years old, without pulmonary symptoms. Lesion discovered fluoroscopically during roentgen examination of gastro-intestinal tract. Carcinoma proven by aspiration biopsy. Pneumonectomy.

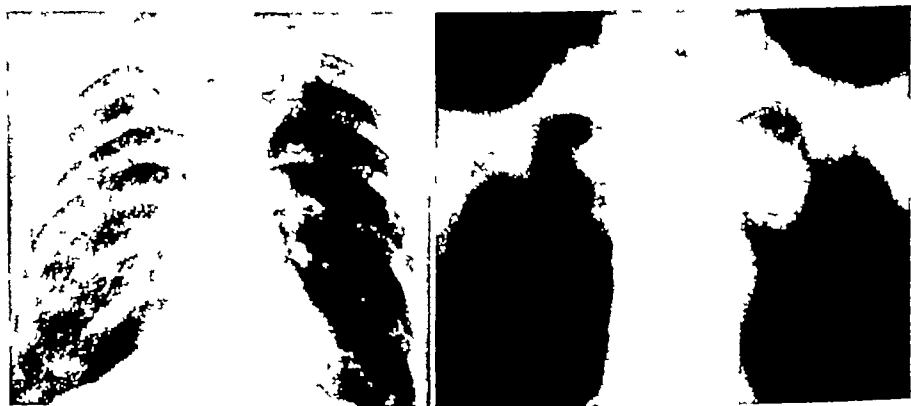


FIGURE 15 Male, 52 years old, complaining of hoarseness (left recurrent paralysis) but without pulmonary symptoms. Carcinoma proven by aspiration biopsy.

a considerable size without giving rise to pulmonary symptoms. Phenomena relating to bronchial obstruction usually do not occur, so that appreciable amounts of atelectasis and secondary infection are not encountered, although there may be cavitation within the tumor itself. The presenting symptoms in cases of this group are often extrapulmonary, metastases are thought to occur rather early, and symptoms attributed to metastasis to the brain, bones or other parts of the body may precede those of the primary lesion.

Peripheral tumors are at times encountered unexpectedly by fluoroscopic examination incidental to roentgen examination of some other part of the body. Figure XIV illustrates the case of a 54 year old male whose gastro-intestinal tract was being examined because of symptoms suggesting peptic ulcer. Although there were no pulmonary symptoms, this lesion was quite evident on fluoroscopy, and tissue obtained by needle aspiration biopsy under fluoroscopic guidance showed carcinoma.

The patient whose films are represented in Figure XV complained primarily of hoarseness and had no chest symptoms. The hoarseness was found to be due to a left recurrent paralysis of the larynx and the peripheral tumor was shown in the x-ray films made as a part of the routine in search for the cause of the recurrent paralysis. The tumor is well shown on the planigram, which suggests that there is infiltration toward the mediastinum in the region of the aortic arch, thus accounting for the recurrent paralysis. The diagnosis in this case too was established by needle biopsy under biplane fluoroscopic guidance.

The peripheral tumors, which constitute about 25 per cent of all bronchogenic carcinomas, are generally not accessible to bronchoscopic biopsy. However, the method of aspiration biopsy, best performed under guidance of the biplane fluoroscope,¹⁴ has been used with success in a rather high percentage of cases where the simpler methods of obtaining tissue are not feasible. In a group of 69 cases in which an attempt was made to obtain material by aspiration biopsy, positive evidence of malignancy was obtained in 45 or 66 per cent, the specimen was conclusive as to cell type (i.e. squamous cell, adenocarcinoma, etc.) in 54.4 per cent of the cases thus proven. As indicated in Table II, 14.5 per cent of the cases seen at the Chevalier Jackson Bronchoscopic Clinic have been proven by aspiration biopsy.

There is not, however, general agreement as to the wisdom of using aspiration biopsy in diagnosis of lung tumors. Craver,¹⁵ in reporting the considerable experience of the Memorial Hospital, finds the procedure a perfectly safe one, he has not observed growth of tumor along the needle tract, nor had he seen evidence of disseminated infection, even when the biopsy was performed

in the presence of suppuration Transitory symptoms attributed to air embolism were observed in two of his cases

Dolley and Jones¹⁶ have mentioned a case in which implantation of tumor along the needle tract apparently occurred, although this was a case in which there was pleural involvement, with pleural fluid presumably containing malignant cells A number of the thoracic surgeons, including Overholt,¹⁷ Adams,¹⁸ Ochsner¹⁹ and others are frankly opposed to aspiration biopsy in any case which is potentially suitable for surgery This stand is based chiefly on the grounds that exploration will be indicated whether or not a positive biopsy is obtained, since a negative aspiration is not generally regarded as completely ruling out the possibility of tumor These authors feel that it is unwise to subject the patient to additional risks of dissemination or other complication, and prefer to confirm the diagnosis at the time of operation

As stated above, resection was found possible in only 12.9 per cent of a series of 269 consecutive proven cases of carcinoma of the bronchus seen at the Chevalier Jackson Bronchoscopic Clinic This series of course included patients in all stages of the disease The rather low incidence of operability in bronchogenic carcinoma may be attributed directly to the fact that, although facilities for the examinations required to establish an early diagnosis (x-ray, bronchoscopy and the others) are now almost universally accessible, they are often not made available to the patient for many months following the onset of symptoms

In the patients of Overholt's²⁰ series, for example, symptoms

TABLE II
BRONCHOGENIC CARCINOMA — 310 CASES
Method of Obtaining Histologic Diagnosis

Histologic Diagnosis Obtained During Life	302 (97 per cent)	No	Per cent
Bronchoscopic Biopsy		221	71.3
Pleural Fluid Cytology		12	3.9
Lymph Node Biopsy		12	3.9
Aspiration Biopsy		45	14.5
Sputum Examination		2	0.6
Thoracoscopic Biopsy		1	0.3
Open Biopsy of Pleura		2	0.6
Exploratory Operation		7	2.3
Histologic Diagnosis Obtained only at Autopsy	8 (2.7 per cent)		

had been present for an average of about 3 months before medical advice was sought. An average additional interval of 3 months had elapsed before the first x-ray examination, and yet another six months had passed before the diagnosis was established. Most cases of carcinoma of the bronchus undoubtedly pass from an operable to an inoperable stage within a few months. In the early stages, there is usually little disability, yet this is the stage in which diagnoses must be made if the present statistics are to be improved. The expanding application of group surveys by the various roentgen methods offers much hope for the earlier discovery of all varieties of chest lesions, for the present, however, progress in the early diagnosis of bronchogenic carcinoma must depend on a general awareness of its frequency, and recognition of the need for adequate study by present-day methods when chest symptoms are unexplained.

SUMMARY AND CONCLUSIONS

1) Cases illustrating the various early clinical and roentgenologic manifestations of bronchogenic carcinoma have been presented.

2) The early manifestations of a bronchogenic carcinoma depend chiefly on its point of origin, so that an arbitrary classification based on location offers a logical basis for understanding the mechanism by which the early symptoms, signs and roentgen abnormalities are produced.

3) To avoid confusion with the other common lower respiratory diseases, thorough clinical study appears advisable in the following groups of cases: (a) Those in which chronic pulmonary symptoms (notably cough, blood-streaking or hemoptysis, wheezing) are not adequately explained, (b) Those in which symptoms or abnormal physical findings persist after what has appeared to be one of the common acute lower respiratory infections, (c) Those in which the roentgen examination shows evidence of impaired bronchial drainage (abnormal density of unilateral, lobar or segmental distribution, unless obviously tuberculous in origin with positive sputum) or impaired aeration (obstructive emphysema, atelectasis of a lung, a lobe or a bronchopulmonary segment). In cases where a tumor-like lesion is evident on the roentgenogram, the need for complete study is apparent. The finding of cavitation not clearly tuberculous in origin should of course call for further investigation.

4) Complete study should include, in addition to the roentgen examination, a bronchoscopy, with bacteriologic study of bronchial secretions, cytologic examination is indicated in those cases in which tissue for biopsy is not obtainable at bronchoscopy. In cases where the differential diagnosis includes tuberculosis, examination

of sputa or gastric washings and skin-testing are in order. Additional procedures which may be indicated in a given case include bronchography, planigraphic study, bacteriologic and cytologic examination of pleural fluid, aspiration biopsy and occasionally thoracoscopy.

5) Exploratory operation is indicated in cases where there is convincing clinical evidence of bronchogenic carcinoma, even though a proven histologic diagnosis is not obtainable, provided there is no evidence of extrapulmonary invasion or metastasis, and provided the operative risk is not disproportionate.

RESUMEN Y CONCLUSIONES

1) Se han presentado casos ilustrativos de las varias manifestaciones clínicas y roentgenológicas tempranas del carcinoma broncogénico.

2) Las manifestaciones tempranas del carcinoma broncogénico dependen principalmente de su lugar de origen, así es que una clasificación arbitraria basada en su ubicación ofrece una base lógica para entender el mecanismo que produce los síntomas, signos y anomalías roentgenológicas tempranas.

3) Para evitar confusión con las otras enfermedades comunes del aparato respiratorio inferior, parece ser prudente que se lleve a cabo un estudio clínico completo en los grupos de casos siguientes: (a) Aquellos en los que no se puede explicar adecuadamente la presencia de síntomas pulmonares crónicos (especialmente tos, esputo veteado de sangre o hemoptisis y resuello difícil y ronco), (b) Aquellos en los que persisten síntomas y hallazgos físicos anormales después de lo que pareció haber sido una de las infecciones agudas comunes del aparato respiratorio inferior, (c) Aquellos en los que el examen roentgenológico revela signos de canalización bronquial inadecuada (sombras anormales de distribución unilateral, lobular o segmentaria, a menos de que sean de indudable origen tuberculoso con esputo positivo) o de aeración defectuosa (enfisema obstructivo, atelectasia de un pulmón, un lóbulo o un segmento broncopulmonar). En casos en los que una lesión que parece tumor se evidencia en la radiografía, es aparente la necesidad de un estudio completo. El hallazgo de cavernas que no sean claramente de origen tuberculoso exige, por supuesto, una investigación adicional.

4) El estudio completo debe incluir, además del examen roentgenológico, una broncoscopia, con estudio bacteriológico de las secreciones bronquiales, se indican exámenes citológicos en esos casos en los que no es posible obtener tejido para biopsia durante la broncoscopia. En casos en los cuales el diagnóstico diferencial incluye la tuberculosis se deben verificar exámenes del esputo y

del lavado gástrico y pruebas cutáneas Otros procedimientos que pueden estar indicados en algunos casos incluyen broncografía, estudios planigráficos, exámenes bacteriológicos y citológicos de derrames pleurales, biopsia por aspiración y, ocasionalmente, toracoscopia

5) Se indica una operación exploratoria en casos en los que hay pruebas clínicas convincentes de carcinoma broncogénico, aun cuando no sea posible comprobar el diagnóstico histológico, con tal de que no haya signos de invasión extrapulmonar o de metástasis, y con tal de que el riesgo operatorio no sea excesivo

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Pulmonary Abscess Secondary to Bland Pulmonary Infarction*

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Much has been written on the subject of pulmonary infarction and its signs and symptoms, but little has been written concerning its course, possible complications and end results. In particular, references to pulmonary abscess secondary to bland infarction have been noted relatively infrequently. The purpose of this study was to determine the incidence of such abscesses, their clinical course and, if possible, something of their pathogenesis.

Specific cases of pulmonary abscess occurring after pulmonary infarction are few, although a number of writers had much to say on the subject. Welch¹ early recognized the possibility when he stated that "even when caused by bland pulmonary emboli, pulmonary infarcts are exposed to the invasion of bacteria from the air passages, and such bacterial invasion might lead to supuration and gangrene." Similarly, Aschner² felt that secondary infection of an aseptic infarct could result in a pulmonary abscess. Kirklin and Faust³ included abscess formation as one of eight possible complications of pulmonary infarction. Lord,⁴ Sante,⁵ and Lillenthal⁶ in their texts all admitted that such a lesion may develop, but they gave no statistics. In his discussion of the symptoms of pulmonary embolism, Bingold⁷ pointed out that frequently emboli present only localized pains in the thorax. After the pains the sputum becomes hemorrhagic or an abscess is formed. While Gsell⁸ did not report cases of such abscesses, he felt certain that they did occur. Ceelen⁹ stated that bronchogenic dissemination of micro-organisms may bring about suppuration of a pulmonary infarct. Murray and MacKenzie¹⁰ in their studies of postoperative thrombosis and embolism found two cases of pulmonary abscess among 349 cases of pulmonary embolism. They felt that these abscesses were due to infarcts which had become secondarily infected, not by bacteria carried in the embolus. Steinberg and his associates¹¹ presented four cases of empyema which followed

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bland infarcts that had gone on to abscess formation Touroff¹² described a similar case of intrapulmonary empyema The largest series presented is that of Chester and Krause¹³ who reported seventeen cases of abscess which developed subsequent to bland infarction These were found in a review of 344 cases of infarction in which necropsy was carried out A study of literature concerning pulmonary abscesses was made and only several additional instances of bland infarction as precursor to abscess were found

Criteria for Selection of Cases

The selection of cases for this study was not always easy Probably the greatest difficulty was in deciding whether or not an infarct was a bland one This was especially true in cases in which operation had been performed and the chance for wound infection was ever present This possibility was emphasized by Culp¹⁴ in his analysis of eighty-eight cases of pulmonary abscess, four of which he felt were due to infected infarcts These four patients had had severe wound infections and septicemia The work of Cutler¹⁵ and of Holman and Mathes¹⁶ demonstrated rather well the fact that pulmonary abscess can develop in a bland infarct in cases of wound suppuration Consequently, any cases in which infection at the operative site was present prior to the time of infarction were omitted

All cases of septicemia were excluded

In many cases the abscess was considered to be secondary to postoperative bronchopneumonia and if the diagnosis of bronchopneumonia could be definitely established, the case was eliminated from this series

Another decision that needed to be made was whether cases in which thrombosis of the peripheral veins, that is, thrombophlebitis, preceded the abscess should be included in this series Any hesitancy to include such cases would have to stem from the belief that every case of thrombophlebitis is a case of infection of the vein as several workers, especially the earlier ones,¹⁷ believed However, in this study an attempt was made to distinguish between infective and noninfective thrombi according to criteria set forth by Murray and MacKenzie¹⁰ These authors observed that in the infective type of thrombosis there was much pain and tenderness over the vein but the rest of the leg showed little or no swelling In such cases a septic fever (temperature ranging between 100 and 104° F) developed and the leukocyte count was as high as 31,000 In the common noninfective type the outstanding feature was swelling of the leg which was usually diffuse and involved the thigh and even the buttock and lower part of the abdomen Tenderness was slight and the average temperature was usually

about 100° F There was only a slight degree of leukocytosis If the thrombus was infected the case was excluded¹⁸

In our series all cases in which pathologic evidence of abscess formation was found were included whether or not a cavity had been formed, but no cases of simple necrosis were included

Clinical Study

Incidence At the Mayo Clinic during the twelve year period from 1932 through 1943, twenty-three cases of pulmonary abscess secondary to bland pulmonary infarction were encountered among 550 cases in which necropsy was performed and infarcts were found The incidence of this lesion as a complication of pulmonary infarction is 4.2 per cent During this same period 6,362 complete necropsies were carried out, so that the incidence of this condition is relatively low (0.36 per cent) In only three cases of this group was the diagnosis made clinically However, at the clinic another group of seven cases were observed in which the diagnosis of abscess secondary to bland infarcts was made, but necropsy was not performed and consequently they were not included in this series

Of the twenty-three cases which comprise this study, the records of nineteen were available for review Four cases were not included in the clinical review These four cases were not studied clinically in the period just prior to death However, necropsy was performed at the clinic

Etiology In so far as possible, these records were analyzed with a view to finding some factors that might possibly be considered of etiologic significance The results of this study are summarized in Table 1 Of the twenty-three patients, only one was less than forty years of age, five were between forty and fifty, and the remaining seventeen were more than fifty The age incidence is not unusual when it is considered that the incidence of pulmonary infarcts in general is greatest in patients more than forty years old

Twelve of the patients of this group were male, eleven, female The sex incidence is comparable to that found by Hosoi¹⁹ for pulmonary infarction in general He noted no variation in incidence between the sexes However, in the series studied by Priestley and Barker,²⁰ infarction occurred one and one-half times as frequently among females as among males Possibly this might be accounted for by the fact that their study was primarily of post-operative infarction

Eight of these abscesses occurred during the postoperative period The eight cases can be further subdivided into two groups In the first group of five cases inhalation anesthesia (chiefly nitrous oxide, oxygen and ether anesthesia) had been used In the re-

TABLE 1

Possible etiologic factors in twenty-three cases of bland pulmonary infarction followed by abscess

Factors	Cases
Age, years	
Under 40	1
40 to 49	5
50 and over	17
Sex	
Male	12
Female	11
Postoperative cases	8
Inhalation anesthesia	5
Spinal anesthesia	3
Cardiac decompensation	2
Nonoperative cases	15
Cardiac decompensation	13
Infection, elsewhere	
Pyorrhea	2
Chronic bronchitis	2
Infected tonsils	1
Cold, laryngitis, bronchitis	1
Wound infection after infarction (?)	1
Peripheral venous thrombosis	5
Occurred post infarction	2
Not diagnosed	1
Diabetes	2

maining three spinal anesthesia had been used Nevertheless, infarction and subsequently abscess developed in both groups The remaining fifteen patients had not undergone operation In thirteen of these fifteen cases cardiac decompensation was a factor

In two cases pyorrhea alveolaris was said to be present In four others a history of chronic infection of the upper part of the respiratory tract was given, two of the patients in these four cases had had chronic bronchitis, one had had infected tonsils, and one had had a cold, laryngitis and bronchitis for the month prior to his death

In five cases there was thrombosis of peripheral veins and in one of these it occurred in an antecubital vein In two others

thrombosis became evident a few days after pulmonary infarction had occurred and in still another case the diagnosis of venous thrombosis was not made clinically, but the condition was discovered at necropsy

Symptoms and signs In reviewing the symptoms in these cases, it was noted that the time of the occurrence of the infarction could fairly definitely be established in cases in which operation had been performed, but that the time of onset of infarction very frequently was not noted in the cases in which no operation had been performed. The time of onset of the infarct after operation falls well within the period of six to twenty-one days set forth by many writers,^{3 21 23} but is a little beyond the four day period which Cutler and Hunt²⁴ noted. The diagnosis of actual abscess was made clinically when it began to form in only three cases. The patients in these three cases had had a cough which was productive of purulent sputum and this led to the diagnosis. Two other patients had had a cough for a month prior to illness, but this was thought to be due to bronchitis. Nevertheless, the cough seemed aggravated after the infarction took place. Thoracic pain as a symptom occurred in seven cases and in only one was the pain of such a nature that it was not interpreted as being due to some pulmonary difficulty. While hemoptysis was noted in seven cases, it seemed more definitely associated with the original infarction. Dyspnea was found in eleven cases, but only two of the patients were not already suffering from cardiac insufficiency. Cyanosis was associated in two of the eleven cases. On examination, consolidation of the involved lung was found in twelve cases, but only five of the patients were not already suffering from heart failure. Friction rub was observed in two cases.

In nine cases the leukocyte count remained normal, in three others it was elevated to 15,000 per cubic millimeter of blood and in the remaining seven a definite elevation occurred several days after infarction. Any count of more than 15,000, which can be found in a case of simple infarction alone was considered abnormally high. In eleven cases the temperature remained normal throughout the course of the patient's illness. In three cases a low-grade rise in temperature to 100.5° F was noted. The elevation was of relatively short duration and might be found in cases of infarction uncomplicated by abscess. In six other cases, the temperature ranged between 101.5° and 103° F and usually began to do so several days after the fever of simple infarction ordinarily would be expected to have subsided. Sputum was blood-tinged in five cases, but patients in three of these had had hemoptysis previously. Unfortunately, bacteriologic cultures of the sputum were not made in these cases. Reports relative to exam-

ination of the sputum were concerned only with the fact that either pneumococci could not be typed or tubercle bacilli could not be found. In the few cases in which blood cultures were made, the results proved to be negative.

Roentgenologic examination The value of roentgenologic examination is questionable, because in only three of the twenty-three cases was there roentgenologic evidence of abscess. Even in these cases the diagnosis of abscess was made on the day, one day after and five days after the patients already had begun to expectorate purulent sputum. Furthermore, in the fourteen cases in which reports of roentgenologic examination were available, the diagnosis of infarction itself was made by this means in only two cases, although it had been suspected clinically in about half of the cases. In the other twelve cases (Table 2) the diagnosis

TABLE 2

Roentgenologic diagnosis in fourteen cases of pulmonary infarction followed by abscess

Diagnosis	Cases
Infarction	2
Congestion and pleural fluid	4
Pneumonic consolidation	6
Elevated diaphragm	1
Pneumothorax	1

was congestion, pneumonic consolidation or bronchopneumonia, elevated diaphragm and pneumothorax. This is not at all unusual when it is noted that many roentgenologists^{3 25 26} are in fairly close agreement that only a small proportion of infarcts show the typical pyramidal form and therefore frequently are missed. The diagnosis of congestion in four cases is not to be considered in particular error since in many instances infarction occurs in cases of cardiac decompensation. Concerning the diagnosis of bronchopneumonia, Jellen²⁵ remarked that frequently surrounding inflammation may be so extensive that an infarct may not be distinguishable from a pneumonic process and distinction between infarction and pneumonia is not always possible at the initial roentgenologic examination.

Diagnosis Considering all these signs and symptoms, even in retrospect, it would be difficult to conclude that an abscess was present, except in the three cases in which purulent sputum had been reported. However, the occurrence of unremitting fever and of leukocytosis in a case in which the patient has had an infarction ought to raise diagnostic suspicion. Similarly an undue amount

of fever in a case of cardiac decompensation should bring to mind the possibility that an infarct has gone on to abscess formation

In the seven cases in which a clinical diagnosis of abscess was made, and which were not included in this study the course was more typical. Infarction was followed by a relatively quiescent period which in turn was followed by a rise in temperature and leukocyte count plus cough productive of purulent sputum. These cases are more definitely similar to the seventeen cases presented by Chester and Krause¹³. It is interesting to note that among the patients in our seven cases not one had any cardiac ailment and in all seven cases the condition occurred postoperatively. However, the degree of rise in temperature and of the leukocytosis were approximately the same as in the group in which necropsy was performed and the presence of abscess might have been suspected ante mortem.

Perhaps before leaving the clinical aspects of this study, it might be well to compare the symptoms of abscesses which develop after bland infarction with those of abscesses which develop after infarction due to an infected embolus. A group of twenty-five such cases were analyzed. These cases by no means represent the total cases of this condition in the records of the Mayo Clinic. The most notable differences between the two groups of cases were that in the cases in which an infected embolus was present the temperature was consistently higher and septic in nature, that the leukocyte counts were for the most part higher, and that the patients were definitely more ill. The temperatures tended to range between 102° and 106° F. An analysis of the leukocyte count showed that in six cases the counts ranged between normal and 15,000 per cubic millimeter of blood, in eight cases, the counts were between 15,000 and 20,000 and in six cases, the counts were more than 20,000. In four cases leukocyte counts were not recorded. In nineteen of the twenty-five cases the condition occurred postoperatively. Results of culture of the blood were found to be positive in twelve cases.

On the whole, little difficulty should be encountered in the clinical distinction between an abscess which develops after bland infarction and one which is the result of a septic embolus and infarction. In the light of this distinction, the term "infected infarct" seems rather loose because it is not clear whether such an infarct was infected secondarily or primarily at the moment the embolus became lodged.

Pathologic Study

Offhand it would seem that the hemorrhagic necrotic region of infarction would provide an extremely adequate culture medium

for the growth of organisms Fisher and Finney²⁷ remarked that it is recognized clinically that pulmonary tissue in which infarction has occurred is very susceptible to infection Yet because of the relatively low incidence of suppurative complications of infarction, the validity of this statement must be questioned In an effort to determine what there is about lung tissue that resists the onslaught of infective agents or what causes a lowering of the protective barrier in the few cases in which abscess develops, this series of cases was studied from a pathologic point of view

Location of the abscess Table 3 contains the results of analysis of these cases with respect to the location of the abscess within the various lobes of the lungs As noted, most of these abscesses

TABLE 3

Location of lesions in twenty-three cases* of pulmonary infarction followed by abscess

Location	Cases	Location	Cases
Right lung	20	Left lung	9
Upper lobe	6	Upper lobe	1
Middle lobe	3	Lower lobe	8
Lower lobe	11		

*Lesions occurred in two lobes in 6 cases

occur in the lower lobes, and this finding is consistent with the findings of many workers^{13 27 30} in regard to the location of infarcts in general In eleven of nineteen cases in which the abscesses were in the lower lobes evidence of cardiac decompensation was present In six cases, two lobes were involved This definitely differs from the findings in the cases of septic infarcts in which many abscesses involve several lobes or many abscesses develop within a single lobe It is interesting to note that in eleven of the twenty-five cases of septic infarct abscesses had developed in other organs of the body, while in the group of twenty-three abscesses after bland infarctions, no other organs were involved

Size of infarction Lemon and his co-workers³¹ felt that the development of an abscess depended in large part upon the size of the occluding thrombus and the resultant infarctions of pulmonary tissue When the infarcts are so large that asphyxia of the central tissues results, softening and liquefaction occur But, is such a necrotic softening of itself an abscess? In this study, as in the one by Chester and Krause,¹³ cases in which only necrotic softening occurred have been omitted However, when the size of the region of infarction and of the abscesses was noted, it was found that abscesses develop in very large or very small

infarcts The largest in this series occupied approximately one third of a lobe, while the smallest was but a few millimeters in diameter However, the majority of the abscesses have occurred in regions of infarction that are fairly large—more than 2 cm in diameter—and in only three cases was the region of infarction less than 1 cm in any diameter This again differs somewhat from the picture found in the group of septic infarcts, since in that group many small regions of infarction developed into abscess

Circulation Any discussion of the size of an infarct quite naturally leads to a consideration of the state of the circulation in and about the region of infarction From a review of the sections in these cases, it can be stated that the evidence of circulation within the region of infarction was practically nil The state of the circulation in the region of infarction may be a factor in the occurrence of infection

Mathes and her co-workers³² showed by means of injection of a radiopaque medium that the bronchial artery supplying the portion of the lobe in which the embolus was located became progressively enlarged until after ten to fourteen days it was very tortuous and many times its normal size The artery could be seen as it followed the course of the bronchus and many of its large branches entered the region of the embolus However, there is some question whether this dilation of the bronchial vessel actually assists in supplying the region of infarction with blood Studies of Karsner and Ghoreyeb³³ demonstrated that, although increases in pressure in the bronchial arteries cause somewhat greater inflow of the mass injected into the bronchi into the region of the embolus, extremely high pressures are not sufficient to provide for complete circulation within the region of infarction On the other hand, in our cases the blood supply seemed to be abundant about the region of infarction, and in those sections in which the infarct was shown in proximity to the pleura, marked dilation and congestion of the vessels within and beneath the pleura was seen Furthermore, the larger the region of infarction, the less likely was the more central part of the infarct to receive an adequate supply of oxygenated blood

Perhaps Welch¹ made a pertinent statement when he stated that, "The fate of a part supplied by an artery closed by a bland embolus depends altogether on whether it is fed within a certain time after the obstruction with enough arterial blood to preserve its function and integrity"

That the mechanism for an adequate collateral circulation is present in cases of infarction has been demonstrated by Ghoreyeb and Karsner³⁴ and by Mathes and her co-workers³² According to Mathes and her co-workers, the blood supply relayed by the

collateral arteries from the bronchial artery is adequate. The artery becomes dilated to assist in speedy repair of the region of infarction. Perhaps it is this dilation which allows enough arterial blood with its oxygen and its cellular elements to be brought to the region of infarction—enough at least to combat any low-grade infection, to aid in rapid healing and to prevent abscess formation.

Source of infection By the criteria laid down earlier in this paper, organisms carried by the original embolus were ruled out as a possible source of infection in this series. However, the possibility still exists that a bland infarct may become infected subsequently by organisms which entered the blood stream after the original bland infarction had taken place. In fact, Holman and Mathes¹⁶ were able to produce experimentally suppurative conditions of bland infarcts by causing suppurative wounds in the experimental animal at a later date. Of course there always exists the moot question as to whether or not a negative blood culture means an absence of circulating organisms.

A review of sections of tissue and emboli stained with brown Gram stains taken in all of our cases revealed that in fourteen of them organisms were present in pulmonary tissue, in the abscesses or in the region of infarction, but in no case were organisms seen within the blood vessels. This evidence might be of questionable value were it not for the fact that in a similar study of septic infarcts and abscesses resulting from them, organisms were demonstrated more readily within the blood vessels. Another distinguishing fact in the cases of septic infarct was that arteritis or arteriolitis frequently was present.

In a study by Naidu,³⁵ pulmonary tissue was cultured at necropsy in seventy-five cases and in sixty-seven of these cases positive results were found. The organisms found were micrococci, non-hemolytic streptococci, *Staphylococcus albus* and hemophilic bacilli. He questioned the fact that the presence of the bacteria per se in tissues contributes to the illness, but he suggested that the liberation of toxins by these organisms is the chief means of harm. That some of these organisms, in addition to the pneumococcus and the *Streptococcus haemolyticus*, might become pathogens and consequently be the infective agents in these cases is not to be denied. Unfortunately, little can be said concerning the organisms in our series, since postmortem culture of pulmonary tissues was made in only one case. The organisms were of the streptococcus group. Of the fourteen cases in which organisms were seen by study with Gram stains, all but one showed cocci. That one case presented a mixed infection due to rods and cocci.

Cutler³⁶ concluded that normally the epithelial lining of the bronchi has a high resistance to infection. The abscesses which

he was able to produce experimentally were developed by secondarily infecting atelectatic regions Yates,³⁷ too, felt that a bland embolus would not cause an abscess to be formed unless the atelectatic portion of the lung were invaded by bacteria from a bronchus

In our study in fourteen of the twenty-three cases regions of atelectasis were found adjacent to the region of infarction and abscess More interesting is the fact that in eighteen of these cases pus was demonstrable in the bronchi even though clinical history of purulent sputum was given in only three cases In a few cases evident bronchitis and bronchiolitis were present Determining whether this bronchitis was a factor in the cause of the abscess or the result of the abscess is quite a problem It is our belief that in many of these cases of infarction there is a concomitant low-grade bronchitis As Hampton and Wharton²³ pointed out, this might be especially true during the first post-operative week, for during that time there is mild bronchitis due to the irritation of anesthesia In cases of cardiac decompensation low-grade bronchitis is present Consequently an infarct in the lungs in such cases might furnish an ideal culture medium in which a low-grade infection might develop into full virulence

Another source of infection that is not to be overlooked is the buccal and pharyngeal regions While in our series some upper respiratory or dental infection was present in only six cases, these regions loom large as possible sources for organisms In a six-year period Kline and Berger³⁸ gave preoperative oral therapy with the result that in 5,078 operations, postoperative pulmonary complications occurred in only nine cases (0.17 per cent) In a similar period sixty (0.68 per cent) of 8,897 untreated patients had pulmonary complications Cutler³⁶ felt that secondary infection might be brought about readily by the aspiration of buccal material during sleep Crowe and Scarff,³⁹ Allen,⁴⁰ Hedblom, Joannides and Rosenthal⁴¹ all concluded, however, that in order for infection to take place by aspiration, the cough reflex must be controlled sufficiently long to allow infected liquids to settle into the alveoli On the other hand, Faulkner and Faulkner⁴² showed the influence of "internal drainage" in spreading infection from one part of the tracheobronchial tree to another and demonstrated that even without the abolition of the cough reflex, iodized oil introduced into the nares before sleep finds its way into the bronchial tree by the following morning Lemon⁴³ demonstrated that when a dog is anesthetized the foot of the table must be 28.75 cm higher than the head in order to prevent the spread of buccal material downward These findings are mentioned to give some strength to the idea that the source of the

infective agent in the development of an abscess from a region of bland infarction might well be derived from the tracheo-bronchial system

Empyema occurred in six of our twenty-three cases. In their series Chester and Krause¹³ reported seven cases of empyema. The occurrence of this lesion should not be thought unusual as a complication of abscesses which develop in regions of bland infarction, since such regions are almost always near the periphery of the lung and consequently are in a position to allow spread of infected material into the pleural space more quickly.

SUMMARY

Findings in twenty-three cases of pulmonary abscess which developed after bland pulmonary infarction are presented and are analyzed.

While the diagnosis was definitely established clinically in only three cases, it is felt that abscess formation should be suspected in any case of infarction in which leukocytosis, unremitting fever and possibly a productive cough develop subsequently.

Pulmonary infarcts are especially prone to develop in cases of cardiac decompensation and in any case of cardiac disease in which illness has been prolonged and unremitting fever has been present the possibility of abscess formation should be considered.

A distinction should be made clinically between septic and aseptic embolic infarction. The term "infected infarct" should not be used unless the mode of infection is made clear.

In so far as the pathogenesis of these abscesses is concerned, it can be concluded that their development in a region of bland infarction depends upon the following factors:

- 1) The size of the region of infarction: the larger the region of infarction, the better the chances for abscess formation.
- 2) The state of blood supply to the region of infarction and the adequacy of collateral circulation.
- 3) The state of the surrounding pulmonary tissue, including such factors as coexistent congestion or atelectasis.
- 4) Bacteriologic factors, which include the presence or absence of dental, buccal and pharyngeal infections, the presence of bronchitis, the virulence of the organisms involved, and the massiveness of the infection.
- 5) The indeterminate, but apparently actively operating, factor of "tissue resistance" to the development of such abscesses in what, at first sight, appears to be a very fertile field for the growth of bacteria.

RESUMEN

Se presentan y analizan los hallazgos en veinte y tres casos de abscesos pulmonares que se desarrollaron después de infartos pulmonares leves

Aunque solamente en tres casos se estableció el diagnóstico clínico bien definido, se opina que se debe sospechar la formación de absceso en todo caso de infarto en el que subsiguientemente aparecen leucocitosis, fiebre continua y, posiblemente, tos productiva

Los casos más propensos al desarrollo de infartos pulmonares son los de insuficiencia cardíaca, y en todo paciente cardíaco que ha estado mal por mucho tiempo y que ha tenido fiebre continua, debe considerarse la posibilidad de formación de absceso

Se debe hacer la distinción clínica entre infartos embólicos sépticos y asepticos. No debe usarse el término "infarto infectado" a menos de que sea claro el modo de infección

En cuanto a la patogenia de estos abscesos, se puede concluir que su desarrollo en un lugar de infarto leve depende de los factores siguientes

1) El tamaño del infarto mientras más grande el infarto, mayor es la oportunidad para la formación de un absceso

2) El estado del riego sanguíneo en la región del infarto y lo adecuado de la circulación colateral

3) El estado del tejido pulmonar circundante, inclusive de factores tales como congestión o atelectasia coexistentes

4) Factores bacteriológicos, que incluyen la presencia o ausencia de infecciones dentales, bucales o faríngeas, la presencia de bronquitis, la virulencia de los gérmenes en cuestión y la masiva de la infección

5) El factor indeterminado, pero aparentemente activo, de la "resistencia del tejido" al desarrollo de tales abscesos en el que parece ser, a primera vista, un terreno muy fértil para la multiplicación de bacterias

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Pneumoperitoneum*

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Spencer Wells,¹ in 1872, opened the abdomen of a woman with tuberculous peritonitis and subsequently noted the marked improvement which followed this operation. In 1883, Mosetig-Moorhoff and Nolan¹ independently showed that laparotomy is not necessary for the healing of tuberculous peritonitis, the air accomplishes the same thing if introduced by needle. In 1933, Vajda,¹ while trying to control pulmonary hemorrhage in a patient with dense pleural adhesions, injected enough air into the abdomen to elevate both leaves of the diaphragm and in this manner controlled bleeding. Joannides and Shlack¹ in 1936, proposed that the phrenic nerve be crushed before instituting artificial pneumoperitoneum. Since 1931, Banyai¹ has studied and extensively written on the beneficial effects obtained from pneumoperitoneum in the treatment of pulmonary tuberculosis.

Pneumoperitoneum, with or without the addition of phrenic nerve crushing, is a form of pulmonary collapse therapy, i.e., its chief purpose is to promote healing of the lung through reducing its volume. Collapse therapy is generally thought to be effective² by encouraging elastic relaxation of the lung and thus affording rest to the affected part and possibly by inducing anoxemia and lymph stasis, both of which are presumed to favor fibrosis of exudative lesions, there is also some evidence that collapse therapy actually causes compressions of the walls of cavities, thus placing these in optimal position for healing.

The indications for and contraindications³ to the practice of pneumoperitoneum have been widely discussed in the literature. We believe that this procedure is best used after the phrenic nerve has been crushed or cut. Since each patient presents his own individual problem, we do not believe that categorical statements can be justified. Suffice it to state that this combined method is indicated generally whenever and wherever collapse therapy is indicated but no other method is feasible, it is contraindicated when the patient is too sick to tolerate any form of mechanical treatment for his tuberculosis.

1 *Effect of artificial pneumoperitoneum on pulmonary volume*

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Crushing or cutting the phrenic nerve is followed by paralysis of the corresponding half of the diaphragm, and the paralyzed diaphragm rises unless fixed by adhesions to the chest wall or to a stiffened lung. This rise reduces the vertical diameter of the lung, thereby lessening the pulmonary volume, following the introduction of air into the peritoneal space, this reduction in pulmonary volume is accentuated. Contrary to general opinion, the diaphragm, during pneumoperitoneum treatment, is not elevated by intra-abdominal pressure alone,⁴ but also by neutralizing the subdiaphragmatic negative pressure and thus permitting free play for the upward pull of the intrapleural pressure. Although phrenic crush itself usually causes a reduction in vital capacity, Banyai¹ found that the combination of phrenic crush and pneumoperitoneum seldom lowered the vital capacity more than 15 per cent. Arterialization of the blood proceeds at a normal rate.

2 Effect of artificial pneumoperitoneum on the heart and circulation One of the more important advantages of artificial pneumoperitoneum as a form of collapse therapy is that it puts comparatively little strain on the heart and circulation. Whereas other forms of collapse therapy, notably artificial pneumothorax and thoracoplasty, do materially reduce the respiratory efficiency of patients, pneumoperitoneum does not. Berg and Benatt⁴ could not find even a consistent lowering of vital capacity in their series. It is true that after a phrenic nerve crush there is reduction in the volume of tidal air, but these changes are transitory. It is significant that the cardiac output is increased about 25 per cent when the ventilated volume decreases 13 per cent, indicating that the increased cardiac output compensates for the decreased pulmonary volume, thus increasing the utilization of oxygen from the air.

Patients treated by artificial pneumoperitoneum have demonstrable electrocardiographic patterns markedly similar to those of acute cor pulmonale. Thus there will be found flattened ST interval in Lead II, large Q wave followed by small R and inverted T in Lead III. It is important to realize that these changes are not due to cardiac disease itself but to a predictable change in rotation of the heart about a horizontal axis lying in the sagittal plane, i.e., the apex of the heart is generally moved upwards and to the left. Studies of the ventricular gradient confirm this view. It is our custom to obtain electrocardiograms immediately prior to and subsequent to the introduction of air into the abdomen as a means of studying these changes. Failure to realize that these changes markedly resemble those seen when acute pulmonary embolism develops may be responsible for diagnostic errors. Benatt and Berg⁴ call attention to the fact that these changes

are reversible and disappear completely on completion of pneumoperitoneum and return of the diaphragm and heart to the respective pretreatment anatomical positions

Technic

A standardized technic⁵ has been published. We believe that attention to certain details is important. The easiest site is the area just below the left costal margin and lateral to the rectus sheath, false passage of the needle is not probable if this site is used. The beginner can estimate the depth of the abdominal wall by the fact that the patient gasps with pain as soon as the infiltrating needle touches the peritoneum, a small amount of procaine speedily abolishes this pain. Although at times no manometric fluctuation is obtained, usually the pressure is recorded as subatmospheric or negative, after a small amount of air flows through the needle, the pressure is positive but soon becomes negative once more as the accomodating effect of the abdominal muscles manifests itself.

Usually the treatment is repeated at intervals of 2 to 3 days until a satisfactory degree of pneumoperitoneum can be demonstrated at fluoroscopy by adequate rise of the paralyzed diaphragm. Then it is generally sufficient to insufflate 1000 cc. of air weekly. Some of our patients need as much as 1800 cc. of air weekly, but this is exceptional. The first treatment may be followed by abdominal discomfort or pain in the shoulder from diaphragmatic irritation, but most patients soon tolerate the air quite well. As the abdomen begins to bulge from the stretching effects of repeated injections of air, the intra-abdominal pressure increases to the point where there is no longer a negative reading 30 minutes or more after completion of a given treatment.

How Effective is Pneumoperitoneum Therapy?

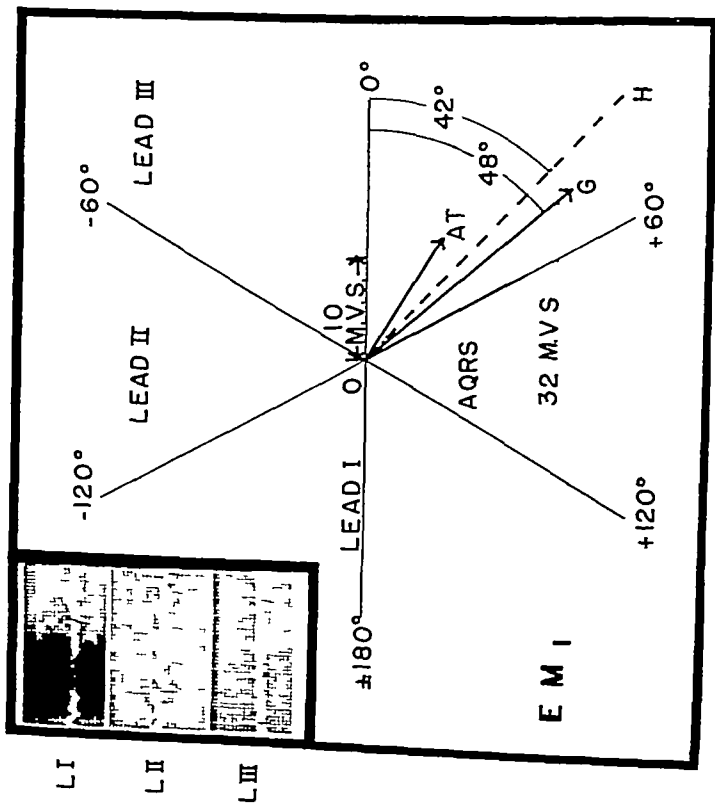
Because pneumoperitoneum therapy, during its early period, was instituted only for hopeless cases, the reported results have not been brilliant. Unless one appreciates that the benefits are those which are extended, for the most part, to patients otherwise doomed to die from progressive pulmonary tuberculosis, he will not be impressed by the apparent cures attained. Despite this, however, several favorable series of cases have been recorded⁶⁻⁸. There may be some question, when pneumoperitoneum is combined with phrenic nerve crushing, which procedure was the more effective. Most authors tend to attribute more good results to the combination than to either of the methods alone. This is still a clinical impression and has not yet been supported by adequate statistics.



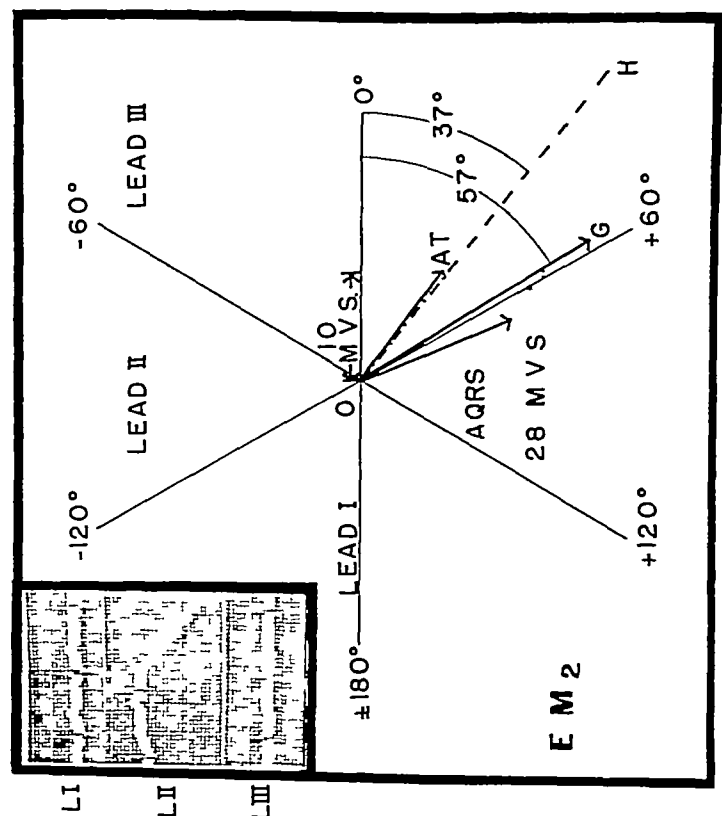
(b)



(a)



(a)



(b)

FIGURE 1 The triaxial reference system suggested by Bayley¹¹ has been used to analyse the forces concerned with the electrocardiogram. The following nomenclature has been employed: G - Ventricular gradient as projected on the frontal plane of the body; AQRS - mean manifest magnitude of the QRS complex determined algebraically and measured in microvolt seconds to represent the mean force of the depolarization process of the ventricular musculature; H - the anatomic or longitudinal axis of the heart as projected on the frontal plane and AT - the manifest mean magnitude of the repolarization process of the ventricular musculature.

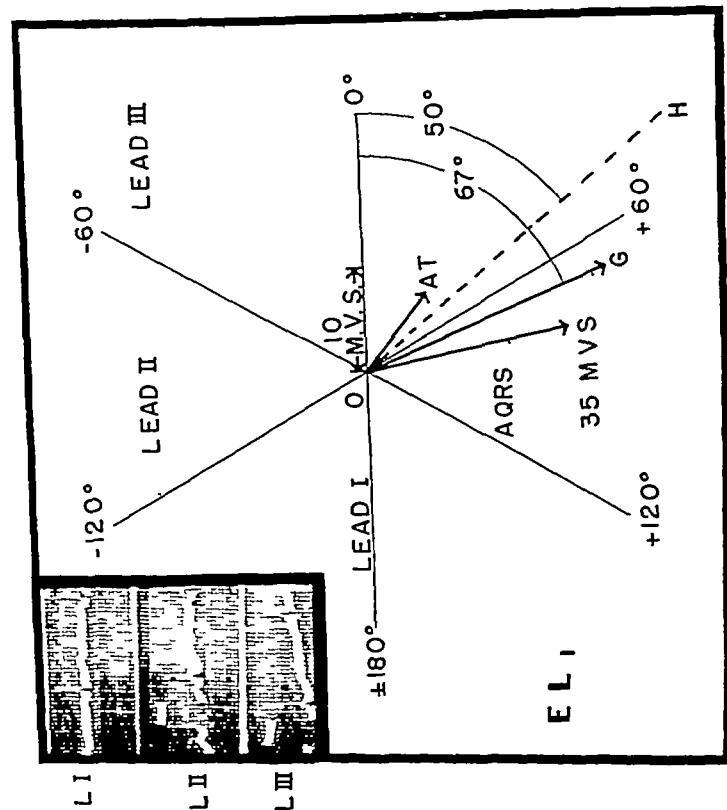
The chest x-ray film and electrocardiogram shown in (a) above were taken before initiation of pneumoperitoneum. G has a magnitude of 35 m.v.s and a direction of plus 67° while the anatomic axis is at plus 50°; these values are normal. After initiation of pneumoperitoneum (b) G has rotated to the right and is now 105° whereas H rotated to the left and is now at plus 35°. These results indicate that clockwise rotation of the heart has occurred although the longitudinal axis of the heart was shifted in a counter-clockwise direction.



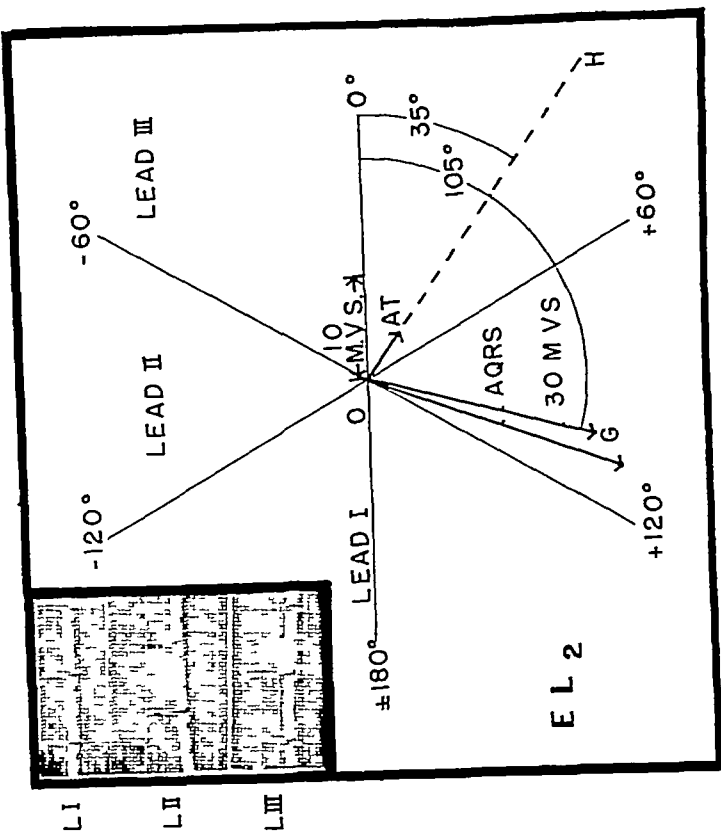
(a)



(b)



(a)



(b)

FIGURE II (Legend as for Fig I) The chest X-ray film and electrocardiogram made before institution of pneumoperitoneum (a) indicate G at plus 48° and H at plus 42°. After pneumoperitoneum was established (b) G shifted to plus 37° while H rotated counter-clockwise to plus 37°. This indicates that there has been clock-wise rotation of the heart about its antero-posterior axis

Complications of Pneumoperitoneum Therapy

1 *Visceral Injury* is a naturally feared but seldom encountered accident Biernaki,¹ in an effort to show that injury to the bowel does not occur, inserted standard pneumothorax needles into the abdomen of cadavers 2 centimeters past the peritoneal limits, in no instance was he able to injure the intestine To minimize the possibility of this accident, we do not insert the needle near the surgical scars of laparotomies where a loop of the gut may be adherent and also insist on an empty bladder and an empty stomach as prerequisites for each refill We do not initiate pneumoperitoneum during menstruation for fear of inciting or aggravating dysmenorrhea

2 *Air embolism* is a serious complication not often encountered in artificial pneumoperitoneum Fremmel⁹ reported only one instance in 218 refills Others have reported similarly on the rarity of the occurrence, and yet some fatalities have been listed by Trimble,¹⁰ Simon¹¹ and Warring¹² The symptoms are precisely the same as when it complicates artificial pneumothorax, and the management is also the same

3 *Accidental injection of air into the thorax and into the skin* usually follow a bout of coughing or some effort as rising abruptly from a horizontal to a sitting posture Accidental pneumothorax seems to have occurred mostly if the pneumoperitoneum had been attempted through the subdiaphragmatic route Mediastinal emphysema may ensue when air escapes through one of the openings of the diaphragm or, more probably, if a sudden straining act initiates interstitial pulmonary emphysema by rupturing an alveolar base Under these circumstances, bubbles of air dissect the sheaths of blood vessels entering the mediastinum at the hilum of the lung This explanation has been offered by the Macklins¹³ If the volume of air is large, the patient will have severe retrosternal pain associated with dysphagia and dyspnea Subcutaneous emphysema is an interesting, but usually harmless, complication first noted by the patient when he feels the crepitations over the abdomen Through the bell of a stethoscope, a characteristic sound may be demonstrated

4 *Atelectasis* is a rare complication due to obstruction of bronchial drainage

5 *Ascites and peritonitis* (analagous to the pleural effusion which complicates artificial pneumothorax) may be seen in about 1 per cent of cases, occasionally leading to adhesive peritonitis and abandonment of this form of therapy

SUMMARY

1) The combination of phrenic crush and pneumoperitoneum is a valuable form of pulmonary collapse therapy

2) When used as part of a collapse therapy program in tuberculosis, it increases the percentage of patients who can be brought to the stage of "apparent cure"

3) The technic is simple, and the complications few

4) It should be used for any patient suited to collapse therapy but not suited to thoracoplasty or to artificial pneumothorax

5) When the indications have become better established, it is possible that it may supplant some of the now more commonly employed measures. Until the demonstration of such indications, it should be used only in conjunction with, and not instead of, other measures

6) Satisfactory results may be expected only if there has been a satisfactory rise in the diaphragm with corresponding pulmonary relaxation

7) The electrocardiographic pattern obtained is similar to that of acute cor pulmonale but can be shown to be due to cardiac rotation with corresponding movement of the ventricular gradient

RESUMEN

1) La combinación de trituración del frénico y neumoperitoneo es una forma valiosa de colapsoterapia pulmonar

2) Cuando se emplean como parte del programa de colapsoterapia en la tuberculosis, estas medidas elevan el porcentaje de pacientes en los que se puede producir el estado de "curación aparente"

3) La técnica es sencilla y las complicaciones pocas

4) Debe emplearse en cualquier paciente en el que sea apropiada la colapsoterapia pero que no sea adaptable a la toracoplastia o al neumotórax artificial

5) Cuando se establezcan mejor las indicaciones, es posible que reemplace a algunas de las medidas que se emplean mas comunemente ahora. Hasta cuando se demuestren estas indicaciones, sólo debe usarse junto con estas medidas y no en vez de ellas

6) Sólo pueden esperarse resultados satisfactorios si ha ocurrido una elevación satisfactoria del diafragma con la correspondiente dilatación pulmonar

7) El patrón electrocardiográfico obtenido es semejante al del cor pulmonale, pero se puede demostrar que se debe a rotación del corazón con movimiento correspondiente de la inclinación ventricular

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Progress in Tuberculosis Control in the United States*

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At last year's Annual Meeting, it was my pleasure to discuss in general terms the tuberculosis control program of the United States Public Health Service. I described the fundamental objectives and major techniques of the Tuberculosis Control Division, organized as an official agency to integrate and guide activities in tuberculosis control throughout the country. I spoke of the success of the Division in cooperative work with voluntary and official State and local agencies engaged in the national control movement, and mentioned cooperative arrangements with prominent research groups. That introduction to the activities of the Division was in itself a promise to speak later of further developments.

Today, with the Division in its fourth year of operation, it is possible to discuss, in some detail, significant projects and results. The most interesting work, I should say, has been in the fields of case-finding and medical research. It would seem appropriate to discuss case-finding first, inasmuch as it provides a measure of the general problem of tuberculosis.

For those who may not be familiar with the Federal case-finding program, I should explain that the Public Health Service operates a number of photofluorographic units for demonstration purposes. At present the Tuberculosis Control Division maintains more than 40 of these units and keeps at least 35 in operation at all times. While demonstrating the value of miniature chest films in detecting early tuberculosis, the units provide direct service to the community, and every effort is made to place them where most needed throughout the States.

The Division frequently conducts chest x-ray surveys among special population groups, such as industrial workers or patients in mental hospitals. These investigations afford valuable information about the tuberculosis problem. For the most part, however, we emphasize the community-wide survey, since it covers the general population as well as special groups, and in this way offers the most to the people in terms of service. In demonstra-

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tions of this type, we attempt to obtain a chest film of every community member 15 years of age or older. The Division has participated in several case-finding surveys in which entire counties were covered—an approach so successful that we hope to further a national program of tuberculosis case-finding by communities.

One of the primary considerations in a large community-wide survey is the time element. We must discover and isolate as soon as possible a sufficient number of open cases to provide a marked reduction of disease hazard for the remaining population. Moreover, the Public Health Service, in the interest of the nation as a whole, must avoid a prolonged concentration of x-ray units in one area. Then again, the problem of waning community interest in the program enforces the time restriction. For these reasons, careful planning and strong community organization are essential.

Basic to any case-finding program is the question of support for the survey. In community-wide demonstrations, the Division furnishes standard, fully automatic units employing 70-mm roll film. Along with these, we assign medical officers for the organization of the survey and interpretation of results, as well as x-ray technicians, nurses, health educators, and reporting methods analysts. In short, the Public Health Service supplies most of the technical personnel and equipment.

The community usually requires outside help to complete the survey within the time limits. In most surveys to date, the State and local health departments have provided funds and personnel necessary for publicity, clerical work, and follow-up. And for cases discovered during the survey, these departments have also provided clinic facilities, nurses, and other workers.

Many groups must take an active part in the planning and organization. The State and local health departments and other official agencies, the voluntary associations, State, local, and others, and working closely with these groups, the private physicians in the area.

At the present time (June, 1947 - Ed), the Division is engaged in a tuberculosis case-finding survey of Minneapolis. Although the results of film readings are not yet available, I should like to discuss this program in some detail, for the planning and organization are exemplary. There is every indication that this survey will be one of the most successful ever undertaken.

The survey was initiated by the Hennepin County Medical Society, and is being sponsored by the Medical Society, the County Tuberculosis Association, the State Cancer Society, and the City Health Department. Many local groups are active participants, such as the Chamber of Commerce, the PTA, hospitals, labor

unions, the YMCA, and churches. The program is directed by the Minneapolis City Health Department in cooperation with the United States Public Health Service.

The purpose of the survey is to discover pulmonary tuberculosis, cancer in the chest cavity, heart abnormalities, and other pathologic chest conditions among all adults in a total population of more than 400,000. About four months were spent in preparing for the actual x-ray work, which was started May 5, 1947 and was to continue until December.

One of the initial preparatory steps was the organization of a committee to reach into every factory, place of business, school and home, for the purpose of explaining why everyone should have an x-ray and how it would be provided. The activities of the press and radio, and the organization of resources for the printing and distribution of pamphlets, banners, posters, and so forth, are directed by a committee on public relations. The immediate expenses of the survey are met by a contribution from the Hennepin County Tuberculosis Association, and a special finance committee has been delegated to raise additional funds.

As part of the community organization, a chest x-ray attitude poll was taken by a Chicago public relations firm. The object was to determine the attitude of employers and members of the general population toward a complete city-wide program, and to estimate the number that would turn out. One hundred and fifteen employers and 413 other people were interviewed personally by experienced field representatives.

The attitudes revealed by the poll were very encouraging. None of the 115 employers interviewed objected to the survey, only one was uncertain. When asked why they thought it a good idea, 41 employers, or 36 per cent, replied that it would aid the general health of everyone in the city. Twenty-nine, or about a quarter of the group interviewed, said that it would help prevent and control disease. Primarily, the employers wanted the assurance that their employees were free from tuberculosis, and more than 90 per cent agreed to grant their employees time for an x-ray.

The response to the general population poll was further indication of a successful educational campaign. Of the 413 men and women interviewed, 403 said they believed the x-ray survey was a good idea. Four did not think so, and 6 were uncertain. The principal reasons given for thinking it a good idea were that the survey could catch tuberculosis, cancer, and heart trouble in early stages, that it would aid in the general health and protection of the city, and that it would find unsuspected cases and help prevent the spread of disease.

As a further step in the organization of the community, a

technical committee of physicians and nurses was established, with the Tuberculosis Control Officer of the City Health Department as secretary. This committee was responsible for planning the follow-up program, and is actively engaged in making clearances with the medical and nursing professions. The city was divided into five large zones, and these into a total of 30 neighborhood operational districts, according to geographic lines and community group interests. Publicity and subsequent x-ray work are concentrated in certain areas, beginning on the outskirts of the city and progressing toward the center. In many communities, this procedure proved highly effective in war bond and community chest drives.

Three mobile and seven portable photofluorographic units, all employing 70-mm film, are used in the survey work, and several other units are held in reserve. Radiologists of the Public Health Service are reading the films.

For the follow-up, a confidential report is mailed to each person whose screening film shows evidence of chest pathology. The report directs the person to the Public Health Center, where he is x-rayed again with 14" x 17" film. If further examination is necessary, he is referred to his private physician, who is informed of the x-ray findings, and persons found to have active tuberculosis are reported to the City Commissioner of Health. After the report is sent to the physician, the follow-up is on the normal patient-doctor basis. This phase of the program has been carefully planned, and assumes all possible assistance from professional groups responsible for diagnosis, treatment, and rehabilitation.

But I must turn, now, from the subject of case-finding to say a few words on basic research. The first project I should like to discuss is the study of minimal tuberculous lesions among student nurses, begun in 1943. The Division in cooperation with the National Tuberculosis Association has gradually expanded the Nurses Study to include research in almost all geographic regions of the United States. Approximately 12,000 student nurses in 76 widely distributed schools are systematically x-rayed and skin-tested, to determine the predisposing factors and earliest manifestations of tuberculosis.

A preliminary analysis of material from the study is in progress, with a view to obtaining a measure of the accomplishments made over the past four years. Films from two of the ten cities in the study, Columbus, Ohio, and Detroit, Michigan, were selected for the analysis, and the hospitals in those cities were regarded as though the study had been completed. All chest films were re-read. A correlation of film and skin-test readings will make possible

the first comprehensive interpretation of minimal lesions as revealed by chest x-ray, and will permit evaluation of the whole minimal lesion study

One of the most interesting phases of the project is the investigation of nontuberculous pulmonary calcification, which has led to a study of certain fungus diseases, such as histoplasmosis. The first results were announced by Dr Carroll Palmer of the Division on May 11, 1945. It was demonstrated that a mild sub-clinical condition, associated with sensitivity to histoplasmin, is responsible for much of the pulmonary calcification observed in negative reactors to tuberculin.

In Kansas City, where nontuberculous calcification is prevalent, the Division established a field station to further the epidemiology of histoplasmosis and to study its relation to other diseases. Approximately 15,000 school children and 5,000 adults in the Kansas City area have been x-rayed and tested with tuberculin and fungus antigens. During the past year, a number of reports on the work of the field station have been published, such as "Histoplasmin Sensitivity among Siblings" by Ferebee and Furcolow, and "Studies of Fungus Antigens" by Arden Howell.

Of the several reports, Dr Howell's has perhaps the widest significance, since it offers a solution to the singular problem of cross-reactions to the fungus skin-tests. The study demonstrates that the percentage and size of cross-reactions between histoplasmin and blastomycin in animals experimentally infected with *Histoplasma capsulatum* and *Blastomyces dermatitidis* are dependent upon the dosage of the antigens employed. If the critical titers are determined and these concentrations are used in the testing, the degree of cross-reaction is small. Dr Howell concludes that histoplasmin and blastomycin are relatively specific for guinea pigs experimentally infected with the homologous fungi.

Another interesting phase of the field station work is a co-operative investigation with Childrens Mercy Hospital in Kansas City. As part of a program to examine all admissions, nearly 400 children have been skin-tested with histoplasmin and tuberculin, and plans have been made to examine pathological autopsy material from patients whose ante-mortem skin reactions are known. Most of the hospital admissions are x-rayed, and the readings are recorded on a card that carries the skin-test data. When autopsy is performed on histoplasmin-positive subjects, the lungs are x-rayed post-mortem, and any lesions found are studied histologically and cultured for tubercle bacilli and fungi. Similar cooperative arrangements have been established with St Luke's Hospital, General Hospital, and the University of Kansas Hospital.

During 1946 one radiologist of the Division read more than 100,000 x-ray films of the chest, in connection with the Nurses Study and Kansas City field station activities. Clinical follow-up work is progressing among children, industrial workers, student nurses, and others tested who show evidence of pulmonary disease.

The Division has also participated actively in the search for an antibiotic effective against tuberculosis. In cooperative studies with the Rockefeller Institute for Medical Research, Dr Alfred Marshak of the Division isolated a harmless plant substance that appears to retard the development of tuberculosis in guinea pigs. The first results of his work appeared early this year (1947 - Ed) in *Public Health Reports*, under the title "A Crystalline Antibacterial Substance from the Lichen *Ramalina Reticulata*"

It would take a great deal of time to describe Dr Marshak's experiments in detail, but I believe you would be interested in hearing of his principal findings, and of his reasons for investigating this particular plant. He observed that *Ramalina reticulata*, commonly known as California Spanish moss, has no integument and contains a very moisture-absorbing carbohydrate. From this, the invasion and growth of bacteria would seem possible, and when Dr Marshak isolated the carbohydrate material, he found it an excellent culture medium. But the relative absence of bacterial growth in the normal plant suggested the presence of an antibiotic substance, which Dr Marshak isolated in crystalline form.

Before the guinea pig trials, *in vitro* tests had shown that the growth of human tubercle bacilli was completely inhibited by the crystals in concentrations of 1 to 50 thousand, and that inhibition was noticeable in concentrations as low as 1 to 2 million. The growth of avian strains *in vitro* was partly inhibited, and the growth of a bovine strain, completely inhibited. In experiments on guinea pigs infected with human tubercle bacilli, there were twice as many deaths among the controls as among the treated group. The crystals can be administered subcutaneously in oil, daily for three weeks, at a rate of 10 to 20 milligrams per guinea pig, without obvious toxic effect.

In association with interested agencies, the Division has planned to secure a sufficient amount of the crystalline material to permit thorough testing.

A comprehensive discussion of antibiotics against tuberculosis must of course include mention of streptomycin. Since 1944, when Waksman isolated crude concentrates of the substance from the soil micro-organisms *Actinomyces griseus*, streptomycin has been the current drug of promise. We are all awaiting the decisive results of streptomycin treatment of tuberculosis in human beings.

As you know, extensive controlled experiments have yet to be undertaken, but results to date not only give hope of suppressive action, even in meningitis and miliary tuberculosis, but also point the way to further investigation

In April of this year (1947), the Public Health Service issued a memorandum to all medical officers in charge of Marine Hospitals, authorizing the cautious use of streptomycin for certain tuberculous diseases Those listed were tuberculosis of the larynx, trachea, and bronchi, tuberculosis of the skin, draining tuberculous sinuses, tuberculous meningitis, miliary tuberculosis, and clinically active pulmonary tuberculosis, when not too far advanced and when not responsive to bed rest or collapse therapy Medical officers were further requested to limit the use of streptomycin in pulmonary tuberculosis to progressive cases and to those that do not have extensive involvement of the lungs

The memorandum continued with these statements

If you use streptomycin in pulmonary tuberculosis, you should be prepared to examine cultures of tubercle bacilli for streptomycin sensitivity at regular intervals There is no point in continuing treatment when tubercle bacilli have developed resistance to streptomycin

Remember also that the usual period of treatment recommended is three to four months, the dosage one to three grams per day Do not start treatment on a case unless you have adequate amounts of streptomycin for the entire treatment period

In renal tuberculosis streptomycin has shown no evidence of permanent benefit, although some investigators report some symptomatic relief Accordingly, its use in renal tuberculosis is not recommended at this time

The memorandum concluded with a warning

Bear in mind that streptomycin treatment is not without complications Deafness vestibular disturbance, dermatitis, fever, nausea, and vomiting are not uncommon

These statements reflect the present policy of the Public Health Service with regard to the streptomycin treatment of tuberculosis

One important research project remains to be discussed the study of BCG vaccination On September 7, 1946, a conference was held in the offices of the Public Health Service, with representatives of seven States, Denmark, and China Guided by recommendations from this conference, the Tuberculosis Control Division will extend its research program to include studies on the effectiveness of BCG vaccine in preventing tuberculosis I should like, now, to review briefly the history of BCG, and to present the recommendations in general terms This will serve to introduce a description of the present BCG studies of the Division, including the vaccination program now in progress in Columbus, Georgia

You may recall that the literature on BCG usually mentions Dixon as the first to attempt immunization with living tubercle bacilli. In 1889 Dixon inoculated experimental animals with an old culture containing club-shaped and branching forms of the organism. A few years later, Trudeau found that the resistance of rabbits to infection was increased by subcutaneous injections of tubercle bacilli of the avian type, and still later, Von Behring immunized calves with human tubercle bacilli, or "bovo-vaccine." Von Behring's method was abandoned when the organisms were later found in the milk. In 1911 Webb and Williams showed that the resistance of guinea pigs could be augmented with minute doses of living tubercle bacilli, beginning with one organism and gradually increasing the dosage, and a few children were vaccinated in this way with apparent success.

Then, in 1924, the French bacteriologist Calmette advocated inoculation with bovine bacilli attenuated by cultivation on bile-potato medium for 15 years. The vaccine, *Bacillus Calmette-Guérin*, was acclaimed in countries of eastern Europe and South America, where French influence was strong. In Great Britain and the United States, however, it was either ignored or opposed, for the most part, until impartial investigations were undertaken about eight years ago, and only today can it be said that we fully appreciate the possibilities of BCG.

The United States Public Health Service and the Office of Indian Affairs, Department of the Interior, began an investigation of BCG in December 1935. The vaccine was to be used in an attempt to reduce the high incidence of tuberculosis among North American Indians. Since there was uncertainty at that time as to the validity of many reports on the subject, it was decided to conduct a controlled study, rather than an uncontrolled broad-scale program of vaccination. The study group comprised 3,007 persons, aged 1 to 20 years, who were selected on the basis of a negative tuberculin reaction. BCG was given intracutaneously to 1,550, with 1,457 serving as controls, and the group was followed for six years with annual tuberculin tests and chest x-ray examination.

During the six-year period, 60 deaths from all causes occurred among the 1,457 children in the control group, and 34 among the 1,550 vaccinated. There were 28 deaths from tuberculosis among the controls, and only four such deaths among the vaccinated group. In short, the results indicated that a high degree of protection was afforded by the vaccine.

The success of the study among Indians urged that the possibilities of BCG vaccination be thoroughly explored, especially among population groups highly exposed to tuberculosis. Accord-

ingly, the conference was held last fall by the Tuberculosis Control Division to consider the use of BCG among such groups, and to make recommendations for further investigation. It was strongly advocated that the vaccine should not be produced commercially as yet, since information is incomplete as to the amount or duration of conferred resistance. But on the basis of all published reports and the experience of members of the conference who had actually performed vaccination, it was agreed that no proved cases of progressive disease among human beings can be attributed to the vaccine. Further research should be undertaken, however, in an effort to reduce the number of severe local reactions.

It was recommended that a single laboratory be established by the Tuberculosis Control Division to produce the vaccine for use in research programs, and that extensive investigations be conducted in cooperation with recognized research groups throughout the country. Research was strongly recommended to measure the efficiency of BCG, to develop a vaccine composed of dead bacilli, and to simplify the vaccination technique. It was suggested that the Public Health Service undertake a controlled study in a community with a population of 100,000 or more, to determine immediate and long-range results. Another objective must be the development of standardized methods for preparing a potent and stable vaccine for use in the United States and, if possible, throughout the world.

And now I should like to say a few words on the controlled program of BCG vaccination among school children, begun recently by the Tuberculosis Control Division in Columbus and Muscogee County, Georgia. As a first step, the parents were asked to sign "consent" cards, which set forth the general procedure and purpose of the inoculations. The children whose parents approved were then tested with tuberculin, and only those whose tests showed no tuberculous infection were vaccinated. Three Public Health Service teams, each composed of a doctor, nurse, and clerk, administered the tests and then the vaccine. To reduce the number of severe local reactions, Rosenthal's multiple-puncture method was used, and with a high degree of success—though I should mention that the time required to vaccinate and the objections of the children to the 30 successive punctures occasioned some difficulty. The problem of sterilization precluded the use of devices for simultaneous inoculation. Dr. Johannes Holm of Denmark provided the PPD, and Dr. Rosenthal, who was present in Columbus as a consultant, furnished the BCG.

It will be several years, of course, before the effectiveness of the vaccinations can be accurately determined, but we can say now that the study to date has been very successful. We attribute

this success, mainly, to the earnest cooperation of the city and county school boards, PTA's, the county medical society, and the State and local health departments. The work in Columbus is the first step in a program of research that will be extended to other cities.

These are a few of the activities and achievements of the Tuberculosis Control Division of the Public Health Service. They appear to reflect the progress of the entire control movement in the United States. All agencies engaged in that movement must have as their primary function the planning of a decisive and concentrated attack to attain four objectives. First, the discovery of every person in the country infected with tuberculosis. Second, isolation and medical care for every patient needing treatment. Third, after-care and rehabilitation. And fourth, protection of the afflicted family against economic distress. The objectives of the Division, and to some extent the methods for their attainment, are in reality common to all who seek the eradication of this disease.

In State and local tuberculosis control work, guidance is the principal role of the Division. It is our practice to withdraw from active participation in a State program as soon as adequate control measures are established, and to serve mainly through financial aid and research. Today, I have tried to show, by a few examples, how the Division provides direct service, and I believe I have covered our most significant research projects.

Although reported figures show that tuberculosis mortality is on the decline, we are all aware that many grave problems confront us in the fight against the disease. The Tuberculosis Control Division is dedicated to assist all interested persons and agencies in solving those problems. It will continue to conduct research, and to provide aid to States through financial grants, training, and direct service to communities. As the States develop smoothly operating programs, the target of the Federal attack will change, until every State and community is prepared to war effectively against tuberculosis.

SUMMARY

During the past year material progress has been made in the several phases of tuberculosis control. Case-finding through mass radiography has been substantially extended. Controlled research on the efficacy of B C G vaccine as a preventive measure has been initiated. The Tuberculosis Control Division has continued the study of histoplasmin sensitivity among nurses. The search for an antibiotic which will be effective against the tubercle bacilli continues with great promise for the future. Results of the use of

streptomycin in miliary tuberculosis, cutaneous fistulae, and tuberculous meningitis are encouraging, with preliminary studies indicating promising results in pulmonary tuberculosis. A crystalline substance has been isolated from California Spanish Moss which appears to retard the progress of tuberculosis in guinea pigs.

By direct services rendered through demonstrations and the loan of personnel, the Division has continued its policy of aid to States and local communities.

RESUMEN

Durante el año pasado se han llevado a cabo adelantos importantes en las varias fases del control de la tuberculosis. Se han extendido substancialmente el descubrimiento de casos mediante la radiografía colectiva. Se ha iniciado la investigación comprobada sobre la eficacia de la vacuna con BCG como medida profiláctica. La División para el Control de la Tuberculosis ha continuado el estudio de la sensibilidad a la histoplasmina entre las enfermeras. La búsqueda para encontrar un antibiótico que sea eficaz contra los bacilos tuberculosos continua con un futuro prometedor. Son alentadores los resultados del uso de la estreptomicina en la tuberculosis miliar, las fístulas cutáneas y la meningitis tuberculosa, y los estudios preliminares indican resultados prometedores en la tuberculosis pulmonar. Se ha extraído una substancia cristalina del Musgo Español Californiano, la que parece retardar el avance de la tuberculosis en los cobayos.

Mediante servicios directos, que han incluido demostraciones y préstamos de personal, ha continuado la División en su plan de ayudar a los Estados y a las colectividades locales.

Experiences in Air Transportation of Patients with War Wounds of the Chest*

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During the early days of the Pacific war and the battle for the Solomons the first mass air evacuation of casualties was attempted by U S Marine Corps Transports During a period of five months an estimated 12,000 casualties were flown to hospitals five hours distant Quoting from an article by Flaherty, T T, Yavorsky, Wm O, Yood, N L and McWilliams, Jos G, published in the July 1943 issue of the Naval Medical Bulletin, the following comments concerning air transport of chest wounds are worth noting .

"Many chest wounds have been evacuated by air In most instances the specific type of injury is not known by the flight surgeon on the plane On the whole, only moderate dyspnea has been encountered below 400 feet Oxygen has been used only with dyspnea and not prophylactically With chest cases flights have been made at altitudes below 1000 feet unless weather conditions demanded higher altitudes for safety of the ship "

In this discussion one death was reported in a patient with a left hemothorax flown at an altitude of 4000 feet for two hours Sudden dyspnea and collapse occurred which was found on autopsy to be due to further intrathoracic hemorrhage occurring in flight An attempt to give plasma failed, aboard the plane, due to collapse of the veins

From another article by McMahon, Alphonse, and Huston, H R, in the November issue of the same periodical entitled, "War Wounds of the Chest," I extract the following

(a) Two hundred seventy-eight cases of war wounds of the chest were encountered at a U S N Base Hospital in the South Pacific

(b) Of the total number 81 were classed as perforating wounds of the chest with primary manifestations in the pleural cavity as pneumothorax, hemothorax, hemopneumothorax, or the secondary evidence of empyema and pleural effusion Eighteen of these were complicated by multiple wounds elsewhere in the body Six of the 81 cases succumbed to the injury Inasmuch as this hospital, not named in the article, was the first base hospital south of the Solomons and received nearly all of its patients by air

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during the early months of the Solomons campaign, it may be assumed that nearly all of the total of 278 cases were flown in

In January 1944, the writer was sent out into the Pacific Theatre to organize and to direct a medical group to be engaged in evacuation of non-effective sick and wounded by air transport. During the battles for Iwo Jima and Okinawa approximately 15,000 battle injuries, and non-effective sick were flown from these two target areas to Naval and Army hospitals in the Mariannas. Among the patients carried by Air Transport were injuries of every description, which involved all portions of the body, and followed the usual percentage distribution of battle wounds in this war, with wounds of the extremities occurring with greatest frequency, followed by wounds of the abdomen and torso and head and neck in decreasing frequency. In the fiercely contested battle for the heavily Jap garrisoned island area of Iwo Jima and the Okinawa groups, the one thing which could be said characterizing battle wounds was that all of them were of more than usual severity.

The causative agents were, quite typically first in frequency, fragments from mortar and hand grenades, followed by rifle and machine gun projectiles, the heavy mortar and shell missiles, and finally, bayonet wounds. Enemy sharpshooters were numerous, well dug in, and perfectly camouflaged, so that the percentage of wounds caused by rifle fire was higher than in almost any other battles of the Pacific, and accounts for a higher than normal incidence of wounds of head and neck and upper or (exposed) parts of the chest.

During the Iwo campaign one squadron of Navy R4D Transports and one of Navy's PBM (sea planes) were employed as Task Group 94 12, responsible for air evacuation. The medical staff then consisted of five medical officers, three Hospital Corps officers, twenty-four flight nurses and twenty-four Hospital Corps men. One medical officer (F S) and three hospital corps assistants were dispatched to the target area to set up a screening and loading unit. This unit had the responsibility for receiving casualties from the Casualty Air Evacuation Hospital near the Air Field, reviewing of casualty tags and medical records, and issuance of instructions for the care of each patient while enroute by air to the Mariannas. Flight nurses and hospital corpsmen were to see all cases with him before embarkation, and were instructed as to any expected or possible emergencies. Any routine medications were to be continued in flight. These consisted of administration of sulfa drugs, penicillin plasma, serum albumen, whole blood, oxygen inhalation, sedatives, etc.

After conclusion of the Iwo Jima operation the total responsibility for air evacuation of non-effective sick personnel and battle

casualties, Pacific areas, was assumed as a function of Naval Air Transport, Pacific Wing, for the Navy, and Air Evacuation Group One was set up at Guam. The administrative details of this organization are not described in this article because of later reorganization. Air Evacuation Group One included the following medical components: "One Captain, MC, USN, as staff medical officer, Six flight surgeons, ranking from Lieutenant to Lieutenant Commander, USN and USNR, Four Hospital Corps officers of the rank of Lieutenant or Lieutenant (junior grade), Eighty-five flight nurses, five of whom had the rank of chief nurse, One hundred and fifty-six flight hospital corpsmen."

Air Evacuation Group One was supplied with Douglas Sky-masters, long-range, four-engined transports similar to those employed by the Air Transport Command and Naval Air Transport Service for long distance cargo and passenger hauling. Those assigned to the air evacuation schedules were equipped with webbing strap litter supports for twenty-eight litter borne patients. Additional seats for four ambulatory patients were also provided. In addition to the regular crew, a flight nurse and a flight hospital corpsman accompanied each trip. Medical equipment and supplies comprised the following items:

(a) One air-borne medical chest, weighing about 70 pounds, containing dressings, instruments, medicines, bed pans, urinals, catheters, etc.

(b) One refrigerated whole blood chest, containing two units each of whole blood, plasma, albumen, and a supply of distilled water and penicillin.

(c) Boxed aviation flight rations were placed aboard each plane just before departure for the target, and consisted of canned fruit juices, soups, and bouillions, crackers, tomato juice, tinned boned chicken, turkey, and tuna, candy, chewing gum, cigarettes and other miscellany. In addition, a carton containing loaves of bread, paper cups, and feeding tubes or bent straws was added. Thermos jugs containing hot coffee and cold water were carried. The fresh water tanks of the plane also were filled before each trip. Two electric hot cups at 12-24 volts were carried in the medical chest.

(d) Twenty-eight steel-poled or aluminum-poled litters were carried, as well as three blankets per patient. These were off-loaded at the target in exchange for loaded litters, and blankets.

After a 1,500 mile return trip of about 7½ hours duration, the patients were disembarked at the Naval Air Evacuation Center at Agana Field, Guam. The unloading was quickly accomplished by roll-a-way step ladder, followed by the unloading of litter cases by roll-a-way two stage loading platform or by finger-lift truck.

All types of injuries were accepted and transported. Only one patient from Iwo Jima and only two from Okinawa died during the trips by plane. In none of these was it considered that conditions peculiar to air travel were responsible for the fatal termination. In the beginning of our operations the screening officer at the target accepted no early chest wounds and only those abdominal wounds which had been successfully operated upon and were well stabilized postoperative cases. During periods of intensive battle with overloads of casualties, it became necessary to transport casualties only a few hours after being wounded. The only criterion used in screening at such intervals was this question: "Is this patient in condition to survive transportation by any means, land, sea, or air?" Patients with continued hemorrhage, in shock, or badly exsanguinated were held for treatment by shock team before being sent out.

Chest penetrating wounds were accepted if there was no marked dyspnea and the patient was reasonably comfortable. Pilots were advised when carrying such loads of casualties not to exceed 2000 feet altitude and flight medical attendants were told to employ oxygen if dyspnea or signs of anoxia developed. One of the two patients who died had a bullet wound through the base of the skull and after ten days in the hospital on Okinawa was sent over for air evacuation suffering from an unrecognized bilateral bronchopneumonia. This patient arrived at Guam in a moribund condition and expired three hours later in Fleet Hospital No. 111. Necropsy disclosed the pneumonia and a basilar brain abscess.

As was intimated earlier in this paper, certain criteria were set up during the first days of our operations. Perforating wounds of the abdomen were not considered good risks for air travel until at least eight to ten days after operation. Penetrating wounds of the chest, with complicating hemorrhage or pneumothorax, and mediastinal injuries were (upon the advice of several early writers on the subject), considered as not suitable cases for air travel. Then, suddenly we were called upon to meet military necessities as they occurred. We were frequently confronted with the choice of moving such patients to the hospitals 1500 miles away, where the best of equipment and skill awaited, or of leaving them to be carted back miles to already overloaded medical facilities not too far behind the line of battle. There was no real choice. We adopted the relatively simple criterion of asking ourselves, "Is this patient capable of being moved by any of the available means of transportation with a fair chance of surviving the trip?" So we began moving recent chest injuries, abdominal injuries, compound fractures, often supported only by temporary splint-

ings, and burned cases, out of the battle area and to the hospital 1500 miles away, and we found that they not only survived the trip but frequently arrived in the Mariannas in better condition than when we first examined them in Okinawa and in Iwo Jima. Out of perhaps 500 chest injuries of all grades of severity and with all of the usual complications, not *one* died enroute, and I do not believe that the 7½ hours of air travel seriously affected the eventual prognosis of any of them.

Physiological Considerations Imposed in Flight

There are several things which were overlooked by the excellent physiologists, internists, surgeons, and chest men, who had predicted dire results if certain categories of injuries were transported by air. Allow me to explain a few of the overlooked factors.

1 First, it was not foreseen that in flying for great distances over open seas, in certain ocean areas and in most seasons of the year there are no violent storm areas which *must be flown through*. Consequently our flights could be set up for either 6000 feet or at 2000 feet, above or below the usual levels of slight turbulence. Several plane loads of most critical cases from Iwo Jima were flown the entire distance back to Guam at 600 to 800 feet. Altitudes up to 2000 feet do not produce anoxia through lowering of the partial oxygen pressure of inspired atmospheric air. It should be explained at this point that air transport of chest injuries over land does not permit of maintaining a constant altitude of 2000 to 3000 feet due to the nature of the terrain. Natural obstructions, such as mountain ranges and high plateaus require altitudes of 8000 to 12000 feet for crossing. No measurable degree of physiological oxygen want has been demonstrated at altitudes up to 5000 feet although there may be some slight effect. Oxygen breathing equipment for aircraft use is set so that the partial pressure of O₂ supplied shall not be reduced at any time below the 5000 foot altitude equivalent. Reduction in absolute atmospheric pressure, too, at the scheduled flight altitudes in the Pacific could not exert any considerable change in volume or pressure of any entrapped gases in lung spaces or in the intestines. Thus all of the physiological objections to moving patients in these categories by aircraft were at once obviated by the selection of lower altitudes for return flights of air transports carrying such cases. These objections certainly would have to be considered, however, in any overland transfer of such cases.

In the summer and fall of 1945 a great many patients were flown back to the States and to Pearl Harbor from Naval Hospitals in the Philippines and from the Admiralty Islands. The question was raised as to possibility of air evacuation of tubercu-

losis cases The answer was as in previous instances—yes, these cases can be transferred by plane, subject to the following exceptions (a) Pneumothorax was not to be performed within seventy-two hours prior to the flight, and (b) cases with demonstrable cavitation or prone to hemorrhage were not to be accepted Pilots were advised to use minimum safe altitude and plane loads of these patients went through at 2500 to 3000 feet altitude No untoward reactions were observed except that these patients occasionally showed cyanosis and dyspnea even at relatively low flight altitudes When oxygen was administered the cyanosis and dyspnea disappeared It would appear on the basis of this experience that cases of pulmonary tuberculosis without cavitation and not too recently relaxed by artificial pneumothorax may be safely transported by air at altitudes not exceeding 3000 feet Medical attendants should accompany such cases in the event of rapidly developing cyanosis or dyspnea Oxygen, of course, should always be available Sedation was almost routinely employed by Naval Hospitals in the Philippines in preparation for the trip

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D I S C U S S I O N

COMDR C H C SMITH, MC, USNR
Bethesda, Maryland

The transport by aircraft of large numbers of injured and sick personnel during the recent war arose out of military necessity The war throughout was one in which our military forces were committed to attacking and defeating an enemy already in possession of large or small land areas, which, in most instances,

he was well prepared to defend Our repeated invasions over beach-heads held by our enemies necessitated the development of an entirely new method of attack combining air, sea and ground forces, which became known as amphibious warfare

Amphibious warfare, or attack on enemy shores from the sea, presupposes or requires the following conditions (1) That our naval forces can maintain control against enemy naval forces of the sea lanes of approach (2) Combined naval, air and ground force coordination in attacking enemy shores and in sufficient force so that beach-heads can be held against any possible enemy attack during the subsequent movement of men, munitions and supplies into the area (3) Heavy casualties must be expected which must be moved quickly and in large numbers from the beach-head over considerable distances back to the supporting bases where our attacking forces have been concentrated and where adequate facilities for their medical and surgical care have been prepared prior to the final movement forward Such movement of casualties must be accomplished by hospital ships, hospital transport vessels, and large transport type aircraft properly modified and equipped for such employment and manned by well trained medical and hospital corps personnel

Eradicating Tuberculosis in Rural Minnesota*

LEWIS S JORDAN, M.D, F C C P **

Granite Falls Minnesota

The accomplishments of the Veterinarians in eradication of tuberculosis among cattle by the use of the tuberculin test were so inspiring that it was decided in 1930 to institute a similar, but modified program for the people in the Riverside Sanatorium district of Minnesota

The 3800 square miles which comprise this district are located in the south central and western part of the State and include four large counties Chippewa, Lac Qui Parle, Renville and Yellow Medicine There are twenty-seven small cities and towns, and approximately 265 rural schools in the district The tuberculosis control work had the following aims

- 1) Find the infected children, so they could be observed throughout their school career and on into adulthood
- 2) Seek the source of infection for each child who reacted to tuberculin
- 3) Eliminate the infective factor, by breaking the contact with the child preferably by institutionalizing the contagious persons or otherwise controlling their disease
- 4) Examine all adult contacts of the children in the schools including teachers, janitors, bus drivers, cooks, office help, etc
- 5) Institute an educational program including talks, motion picture films, literature, etc, to reach all lay groups and civic organizations
- 6) Institute a follow-up program, checking each tuberculin reactor by x-ray films of the chest at least once each two years, or more often if indicated
- 7) Obtain 100 per cent cooperation from the State and local medical societies
- 8) Aid the veterinarians' program of eradication of tuberculosis among animals, particularly cattle, so no human would be infected with the bovine type of tubercle bacillus

An intensive educational program was begun to gain the cooperation of school boards, lay organizations such as Rotary, Kiwanis, Lions, Commercial Clubs, American Legion, Parent Teachers organizations, Farm Bureau groups, etc With the backing of these organizations and a ruling by our Attorney General, Harry H Peterson, "that the mantoux skin test for teachers and other school employees is a reasonable exercise of police powers of the

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school boards, if required for the purpose of safeguarding the health of the pupils of public schools," our Tuberculin Testing surveys were instituted

School boards could legally require all employees, including teachers, to prove themselves safe to act as guardians of our children during the school hours. Each child was given a blank consent form to be signed by the parent or guardian for the administration of the Mantoux test and, if a reaction occurred, x-ray film inspection of the chest. No test was given without written permission. At the same time it was explained that it would be necessary to x-ray all reactors, and that if the individual was able to pay a fee, \$1.00 would be charged to partially cover the cost of the film. The additional cost of the entire examination was derived from Christmas Seal money. For persons unable to pay, the entire expense was borne by this fund. All reactors were x-rayed regardless of their ability to pay. Care was taken to explain that the \$1.00 did not cover the cost of the work and materials, and that the balance was provided by Christmas Seal money and the Sanatorium.

Our goal was high even in the early days of the program. We established the rule that the children of no school would be tested unless consent blanks were returned by a minimum of 80 per cent of the pupils. This placed the responsibility for the testing program on each community where the work was to be done. Parent-teacher groups worked hard to obtain the 80 per cent consents. A spirit of rivalry developed between various towns and schools which practically always assured the success of the program. Every effort was made to retest the schools each two years. Saranac Lake Old Tuberculin 1/1000 strength was used in all our tests. Comparisons of this and PPD were used on certain occasions during the years, as were readings at 48-72 and 96 hour intervals. It was found that a 72 hour reading is more accurate than the 48 hour intervals, owing to the fact that it detects some of the so-called "delayed reactions," as well as eliminates the possibility of interpreting small areas of erythema due to trauma, etc., as tuberculin reactions.

In every instance diligent search was made to determine where the reactors received the infection. Here our field nurse and the knowledge of the family physicians proved of great value. In many instances the source of infection was found in a grandparent, an uncle, an aunt, hired man, etc., who had unsuspected or undiagnosed infectious tuberculosis. During the first several years of this program we found twelve teachers with demonstrable tuberculosis, of whom eight had positive sputum. In one of our larger schools 42.6 per cent of the pupils in one room reacted

to the Mantoux Test The teacher also reacted and the x-ray films of the chest revealed evidence of disease which was proved to represent Far Advance "C" pulmonary tuberculosis This teacher died in a sanatorium within sixty days of discovery Of the pupils who reacted to tuberculin in this teachers' room, two developed demonstrable active pulmonary tuberculosis within a year

All teachers and school employees found to have contagious tuberculosis were removed from contact with the children This work went on yearly with pleasing results Over 50,000 children were tested and the percentage of tuberculin reactors found in the same schools decreased as the years passed

The following table shows the decrease in the percentage of tuberculin reactors in some of our schools observed during the years of the surveys

	Year	Percentage Reactors
Clara City	1935	11 6
	1946	0
Clara City (Parochial)	1934	30.5
	1946	0
Boyd	1931	15 6
	1946	0
Bird Island (Parochial)	1931	25 7
	1947	2.2
Bellingham	1935	7.5
	1946	0
Fairfax (Parochial)	1934	6 9
	1946	0
Milan	1930	18 6
	1946	0
Olivia (Parochial)	1934	14 4
	1946	2 7
Rosen	1934	8.8
	1946	0
Nassau	1937	8 8
	1946	0
Madison (Parochial)	1934	8 1
	1946	0
Echo	1931	10 8
	1946	2 6
Montevideo	1934	13 6
	1946	3 4
Marietta	1931	17 9
	1946	3 4
Olivia	1934	11 5
	1946	4 1
Hanley Falls	1932	11 7
	1946	1.3
Boyd	1931	15 6
	1946	1 8

	Year	Percentage Reactors
Fairfax	1934	21 3
	1946	1 7
Wood Lake	1930	8 6
	1946	1 8
Clarkfield	1933	9 6
	1946	4 1
Morton	1934	13 6
	1946	2 7
Sacred Heart	1933	21 2
	1946	3 0
Franklin	1934	12 2
	1946	3 5
Renville	1934	7 4
	1946	4 2
Yellow Medicine County	1935	8 2
Rural (84 schools) Yellow Medicine County	1946	9

The Minnesota Sub-Committee on Tuberculosis of the American School Health Association consists of such persons as Dr E A Meyerding of St Paul and Dr S A Slater of Worthington, both inspiring leaders and pioneers in this work. In 1943 this Committee prepared standards by which individual schools or whole systems in Minnesota might be certified with reference to tuberculosis. In order for a school to be certified, it must meet these standards which pertain to tuberculosis control work in progress. Those meeting the highest standard were offered Class "A" certificates, while those with slightly lower qualifications received Class "B" certificates. The requirements for Class "A" certification are briefly as follows:

- 1) Testing from 95 to 100 per cent of pupils and making x-ray inspections of the chest of all reactors
- 2) Testing 100 per cent of the school personnel and requiring x-ray film inspection of the chests of all reactors. This includes teachers, janitors, bus drivers, cooks, clerical help, etc.
- 3) Completing the examination of all who presented x-ray shadows which might be caused by tuberculous lesions.
- 4) Conducting an educational program for the staff of each school so that the principles of tuberculosis control would be understood.
- 5) All non-reactors to tuberculin to be retested each two years.
- 6) All reactors to be x-rayed each two years, unless more frequent inspections were especially indicated.

For the Class "B" certification, the requirements were exactly the same as for Class "A" except that only 80 to 95 per cent of the pupils be tested.

In January 1946, work was begun in an attempt to accredit as many schools as possible under this new program of the American School Health Association. A summary of our 1946-47 work toward accrediting all of our schools is as follows:

Number of Schools tested	277
Number of Schools Certified	225
Class "A" certificates awarded	161
Class "B" certificates awarded	64
Number of Schools 100 per cent tested	138
Number of Schools with <i>No tuberculin Reactors</i>	219
Number of Children tested	12,666

The percentage of school children tested and the percentage of reactors found in each of our four counties in 1946-47 is as follows

	Per cent Tested	Per cent Reactors
Yellow Medicine County	91.4	3.0
Chippewa County	90	2.2
Renville County	86.3	3.4
Lac Qui Parle County	90	2.3

In these same counties an average of 13.9 per cent of the children reacted to tuberculin from 1930-1934

In making these surveys members of school personnel were tested at the same time as the children. The age range of adults tested was from 21 to 71 years. An older age average was maintained during the war period due to the lack of younger personnel in the schools, so that many of the teachers were well over 45 years old. The total number of adults tested was 3,698, of whom 801 (21.6 per cent) were reactors and 2,897 were non-reactors.

Most of our cases of pulmonary tuberculosis in the future will develop among these persons who are reactors to tuberculin today. Therefore, not only control but also eradication of tuberculosis can be accomplished by the foregoing program. It is a matter of starting at the "grass roots" to eliminate tuberculosis. In other words, begin with the child to find the infection, then discover its source. Eliminate the fountain head of tubercle bacilli, either by controlling the disease or by hospitalization. Carefully watch the infected children, make x-ray film inspection of their chests annually as they approach and continue on into adulthood. If x-ray shadows appear, complete the examination for tuberculosis. We do not make a diagnosis from x-ray shadows alone.

The weapons are now in our hands, they must be used with arduous work to eliminate tuberculosis. The main weapons are the Mantoux test, the X-ray, complete examination when shadows are found, and the field nurse. No single phase of the examination is adequate. All must be used together to conquer this scourge of mankind. In areas where there is a low incidence of tuberculosis, we feel that the tuberculin testing survey should always come first. The x-ray inspection of the chest can then be limited to the reactors, rather than a mass x-ray program. When a

tuberculin reaction is present, two important facts are immediately established

- 1) The individual has at least primary lesions and is a potential case of clinical tuberculosis
- 2) There has been a source of infection which may be sought and often found among the individual's adult contacts in daily life

The simple fact that a person reacts to tuberculin immediately arouses an intense interest in tuberculosis and a desire for information concerning the ultimate outcome of this infection. The logic of periodic examinations, including x-ray film inspection of the chest, appears to be obvious to them and their cooperation is easily gained. On the other hand, if only x-ray film inspection is made as is practiced in mass x-ray surveys, and the findings are reported as normal, it is often exceedingly difficult to maintain that individual's interest in subsequent periodic examinations, which may often be indicated. A tuberculin reaction gives us a definite hold on the individual and affords the knowledge that he has been infected. This knowledge alone in most cases assures us of full cooperation thereafter. To us it seems far more important to concentrate our attention on the tuberculin reactors where potential clinical tuberculosis exists, than to devote time, energy and money for the making of x-ray inspections of the much larger number in whom there is no possibility of finding clinical tuberculosis.

We believe that tuberculosis in rural Minnesota can be eradicated by this method. In fact, it has been eradicated from the children in a large number of schools. It would be a tragedy to introduce BCG in an area such as ours. To artificially establish sensitivity of the tissues of all of our citizens would be to destroy our most potent weapon—the tuberculin test. It must be remembered that in order to develop clinical tuberculosis, infection must first occur. If we eliminate the sources of infection, and carefully watch those few whose tuberculin test shows that they have been infected, we have every reason to believe that tuberculosis will be relegated to the same category as typhoid fever and small-pox in our entire state within the life span of the coming generation.

SUMMARY

1) An eight-point tuberculosis control program was developed in a four-county tuberculosis sanatorium district in 1930. This included measures for preventing the dissemination of tubercle bacilli of both the bovine and human types. Then 13.9 per cent of the school children reacted to tuberculin. In 1946 and 1947,

only 27 per cent of all the children in the same schools reacted

2) Among the 277 schools of the district there were 219 in which no child was found to react to tuberculin in 1946 and 1947. Thus, in these areas tuberculosis has been completely eradicated at this age level

3) Certification of schools on the basis of tuberculosis control work in progress has been found of extreme value in stimulating interest and activity of the public in all tuberculosis control measures

4) This accomplishment has been made through the tuberculin test as the first line of attack, x-ray inspection of the chests of the reactors, tracing to the source and giving instructions by the field nurse, complete examination of all who react to tuberculin and show x-ray shadows for accurate diagnosis, and hospitalization and isolation of those found to have clinical and contagious disease. The dangers of the bovine type of tubercle bacillus to humans were not overlooked

5) The methods here described are easily applied and thoroughly efficacious. They can be employed wherever tuberculosis workers have the will to eradicate the disease

RESUMEN

1) En 1930 se puso en efecto un programa de ocho puntos para el control de la tuberculosis en un distrito sanatorial de tuberculosis compuesto de cuatro Condados. Este programa incluyó medidas para evitar la propagación de bacilos tuberculosos tanto de tipo bovino como humano. El 13.9 por ciento de los niños de escuela reaccionaban entonces a la tuberculina. En 1946 y 1947 solamente reaccionaba el 27 por ciento de los niños de estas mismas escuelas.

2) Entre las 277 escuelas del distrito hubo 219 en las que no se encontró ningún niño que reaccionara a la tuberculina en 1946 y 1947. De manera, pues, que en esos lugares se ha erradicado por completo la tuberculosis hasta esa edad.

3) Se ha notado que la certificación de las escuelas a base del esfuerzo empleado en el control de la tuberculosis ha sido de gran valor en estimular el interés y la actividad del público en todas las medidas para el control de la tuberculosis.

4) Se ha logrado este éxito, en primer lugar, mediante el uso de la prueba a la tuberculina, seguida después de la inspección radiográfica del pecho de los reactores, del descubrimiento de la fuente de infección y de órdenes expedidas por la enfermera de campo, de exámenes completos de todos los que reaccionan a la tuberculina y revelan sombras en la radiografía, para hacer un diagnóstico exacto y de hospitalización y aislamiento de aquellos

que se descubran con enfermedad clínica y contagiosa No se pasaron por alto los peligros que pueden causar a los seres humanos los bacilos tuberculosos de tipo bovino

5) Los métodos aquí descritos son de fácil aplicación y completamente eficaces y pueden ser empleados dondequiera que las personas que luchan contra la tuberculosis tengan el poder de voluntad de erradicar la enfermedad

The Brompton Hospital A Centenary Review*

CLIFFORD HOYLE, M.D., F.R.C.P.
London, England

"People will not look forward to posterity,
who never look backward to their ancestors"
Edmund Burke, Reflections on the Revolution in France

Mr Chairman, Ladies and Gentlemen,

May I express my warmest thanks for your invitation to address this College. I have chosen the Brompton Hospital for my subject because its history will be new to most of you, even to those for whom the name is closely bound with the development of thoracic medicine in England. As the hospital is honored by your invitation it is fitting to mark the occasion in this way and to commemorate the great figures in English medicine who have served Brompton in the past. Brompton recently attained its centenary so that its history spans almost the entire period within which our present knowledge of chest disease has evolved.

At the time of Brompton's foundation England had a population of fifteen millions, of whom an eighth were herded in London and nearly sixty thousand died yearly from consumption. Disease and child labor together made the expectation of life for a workman not much more than seventeen years. The state of affairs was widely realized only through the novels of Dickens, Disraeli and Charles Kingsley, through Engel's account of the condition of the working class, and through Lyon Playfair's Report on the Health of Towns. Together these made a deep impression on the public mind, and a few years more saw the idea of humanitarianism become a living force.

One of the early signs of this was the foundation of Brompton. The occasion was commonplace: a city clerk with consumption was unable to gain admission to a general hospital. But the clerk concerned had won the bounty of a wise employer, a leading solicitor Philip Rose, who organized a public meeting to establish a special hospital. The "Morning Herald" of May 29, 1841, reported that "a highly respectable meeting was held at Hanover Square Rooms" at which a resolution was passed to found a hospital as an asylum for consumptive patients and as a means of furthering

*Presented at the 13th Annual Meeting of the American College of Chest Physicians, Atlantic City, June 7, 1947

knowledge of the disease The Queen gave her patronage, and Manor House at Chelsea was leased for twenty patients from September 1842, with an Out-Patient Department at 20 Great Marlborough Street Patients nearby, too ill to attend, were visited

at their homes, pupils were admitted to the wards and lectures were organized At the Second Anniversary Dinner in May 1943 Mr Charles Dickens was a steward and proposed the toast "Prosperity to the Hospital" Unfortunately we have no record of what he said, though in a letter to Jerrold his views on the other speakers were pretty terse "There were men there who made such speeches and expressed such sentiments as any moderately intelligent dust-man would have blushed through his cindery bloom to have thought of"

Meanwhile, Philip Rose and his friends were busy with the new hospital A site was chosen

at Brompton, a village in Kensington "remarkable for the salubrity of its air," and "surrounded entirely by nurseries and garden grounds which were among the first cultivated in this country" The ground was formerly part of the botanical garden founded in 1789 by William Curtis, a noted entomologist and author of *Flora Londinensis* The foundation stone of the hospital was laid there by the Prince Consort on June 11, 1844, and sixty beds were in use by November 1846 A further wing was added a few years later with funds raised at a concert by Jenny Lind in Her Majesty's Theatre on Monday, July 31, 1848 Two novel features of the building were the division of wards into small rooms, and ventilation by warmed air through underground tunnels This system, invented by Dr Arnott, was de-



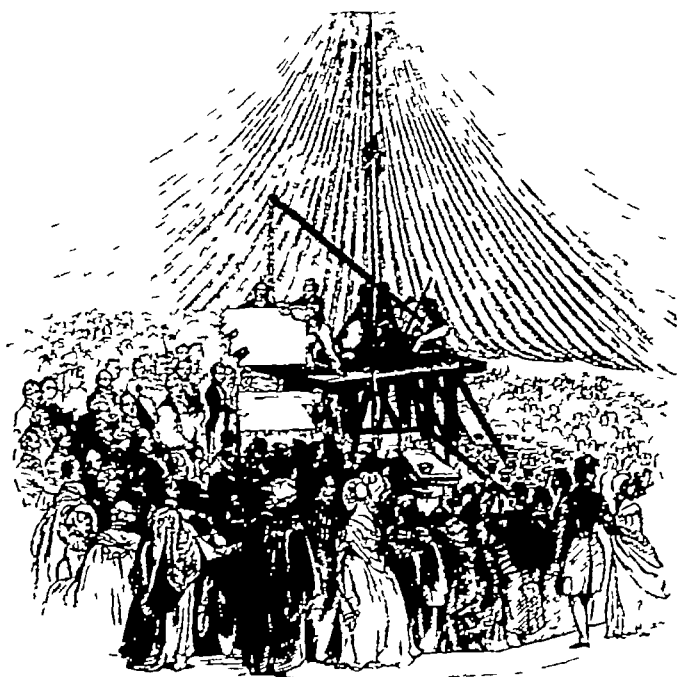
FIGURE 1

Plan of Brompton from 'Cruchley's new plan of London improved to 1835' in 'London in the Nineteenth Century' by Sir Walter Besant Black, London, 1909



FIGURE 2

The "White Hart," Knightsbridge, 1820 From "Old and New London" by E Walford London



H.R.H. PRINCE ALBERT LAYING THE FIRST STONE OF THE NEW HOSPITAL FOR CONSUMPTION ETC., FULHAM ROAD.

FIGURE 3 Brompton Hospital 'H R H Prince Albert laying the first stone of the new hospital for consumption etc Fulham Road' (*The Illustrated London News* June 15 1844 page 388)

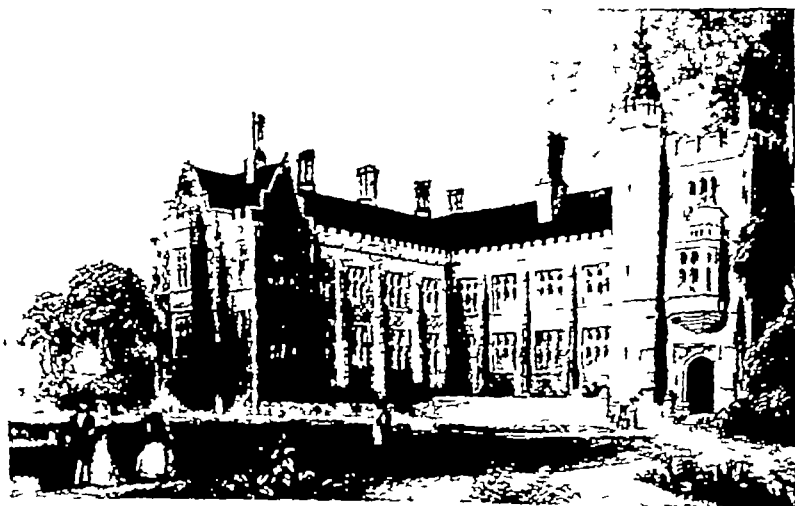


FIGURE 4 Hospital for Consumption and Diseases of the Chest (Brompton)
From *Tallis Illustrated London* by W Gaspey London 1852



*Jenny Lind,
1849*

FIGURE 5

Jenny Lind, 1849 From "The Life of Jenny Lind" by R. Maude Cassell, London, 1926

then retired to study in Edinburgh. He seems to have been a master of the art of living, for he wrote a charming book on the relation of happiness to work and knowledge, and in middle life climbed from the status of a country practitioner in Penzance to that of a prosperous consultant, a Court Physician and a Fellow of the Royal Society.

But Forbes was more than a successful man of his day. He was an eminent geologist, and the first English translator of Laennec's great work in 1821. It is altogether fitting that this fine service to thoracic medicine should have come from the man who later in life was to do much for Brompton. He translated Auenbrugger's book also, adding cases of his own to illustrate percussion, and for twelve years edited

scribed in *The Builder* of 1847, and was used until open windows became the rule. A second large block added in 1879 with a legacy of 100,000 pounds sterling from Miss Cordelia Reed, brought the total beds to 368, besides adding other facilities. Many years later, in 1908, the International Tuberculosis Congress at Washington awarded Brompton the prize of a thousand dollars for the best hospital exhibit of the treatment of the more advanced cases of consumption.

Among the first members of the medical staff, Sir John Forbes, Walter Walshe and Robert Liston have left enduring names in British medicine. Liston was already past the zenith of his career and died in 1847. Forbes, a man of many parts, was a Scot from Banffshire who served at sea through the Napoleonic wars and



CLAIRVILLE COTTAGE, BROMPTON
Jenny Lind's first home in London

FIGURE 6

Clairville Cottage, Brompton. First home of Jenny Lind in London. From "The Life of Jenny Lind" by R. Maude Cassell, London, 1926.

the British and Foreign Medico-Chirurgical Review which became the leading medical journal of the day Forbes excelled with his pen at a time when medical authors commonly wrote good prose

Like his senior colleague, Walshe, too, had literary gifts But he had, as well, the mind of the pioneer Born of Irish stock in Dublin, he studied in Paris with that great inspirer of youth, Pierre Louis, whose "Phthisis" he translated for the New Sydenham Society in 1844 Here in Paris he met Oliver Wendell Holmes and the two friends kept up a correspondence until death parted them Walshe's own writing began with a brilliant little book,



FIGURE 7 Brompton Hospital for Consumption and Diseases of the Chest foundation stone laid on 11th of June 1844 (Lithograph by T G Dutton, published by Day and Haghe)



FIGURE 8 The Consumption Hospital Brompton. (From "Old and New London" Volume V page 103, Cassell London)

"The Physical Diagnosis of Diseases of the Lungs", but his chief work was "A Practical Treatise on the Diseases of the Lungs and Heart," published in 1851. It is one of the most penetrating and best written monographs on the subject in English. He was also responsible for one of the earliest papers from Brompton, a "Report on Pulmonary Phthisis as observed at the Hospital for Consumption, Brompton," which appeared in the British and Foreign Medico-Chirurgical Review of 1849. Walshe had wide interests and a most observant mind. We owe to him the precise description of moveable kidney and of cephalhaematoma. He was among the earliest to recognize the presystolic character of the direct murmur of mitral stenosis, and the first to describe the contracted pupil of aortic aneurysm and to associate sudden death with an aortic reflux.

Two very differing personalities joined the medical staff in 1848, Richard Payne Cotton and Richard Quain. Cotton was then only twenty-eight, and while still a young man, four years later, wrote his book "The Nature, Symptoms and Treatment of Consumption," which has historical importance because his unorthodox opinions on many controversial matters have since become common teaching. For instance, he believed that phthisis was not occasioned by pregnancy unless there was a disposition to it, the disease



FIGURE 9



FIGURE 10

FIGURE 9 Sir John Forbes (1787-1861) (Lithograph by Maguire, 1848)
FIGURE 10 Richard Payne Cotton (1820-1877) (From Leaders in Medicine and Surgery, 1876, No 35, Barraud and Jerrard, London)

affecting large families only when it was already rooted there, observations now explained in terms of close contact. He showed, too, that there was seldom any ill effect during gestation, the harm appearing afterwards, for which prolonged lactation was much to blame. Cotton also described phthisis in children, recognising affection of the bronchial glands as a cardinal feature, with symptoms due to bronchial compression. Nearly twenty years after the appearance of his book Cotton again showed how fresh were his powers of observation when he gave the first account of paroxysmal tachycardia.

Sir Richard Quain is memorable chiefly for his humorous personality and as an after-dinner speaker, for his part in the public side of the profession and as Lord Beaconsfield's physician. His one detailed publication, "On Fatty Diseases of the Heart," which appeared in 1850, is remarkable as an example of the ease with which important evidence can be disregarded. It is an account of 83 cases with necropsy findings. Yet so fixed was his attention upon epicardial adiposity that the ossified or obstructed coronary

arteries, found in 25 of his series, were dismissed as unimportant. Here he was in good company, for such an astute observer as William Stokes did the same.

In 1849 the first Medical Report of the Hospital gave an analysis of 4,358 consumptive patients, the largest series to be reviewed until then. Though conditions other than tuberculosis must have been included to some extent, the conclusions were accurate on many points: the age, sex and occupational incidence of the disease, for instance, and the frequency of haemoptysis. Occupation was epitomised in the brief sentence "there are certain pursuits which exercise a directly injurious influence on the health of those engaged in them—particularly those which compel persons to work in close, ill-ventilated and over-heated rooms"—an opinion well ahead of its time seeing that the tax



FIGURE 11

Richard Quain (1816-1898) (Cartoon by SPY from *Vanity Fair* Dec 15 1883)

on windows was not yet repealed The Report also dealt with John Hutchinson's Spirometry—for he was, of course, the inventor, studying more than 3,000 patients at Brompton by invitation before he was appointed to the Staff in 1855

That our ancestors had an eye for statistics was shown not only by this first Report and by a second thirteen years later, but also by the astonishing book on "The Elements of Prognosis in Consumption" by Edward Pollock which appeared in 1865 Pollock took ten years to collect his material, using 3,500 cases seen at Brompton and analyzed with the help of a statistician Even today there is not much to add to what Pollock wrote about the natural history of consumption We can define the forms better and we know early tuberculosis in a way quite hidden to Pollock and his time But with these reservations his chart of the course of its various types is still reliable He emphasized the latent character in old age, as well as in those with emphysema and rheumatic heart disease He knew that clubbing meant very chronic disease He showed how a good prognosis for spontaneous pneumothorax in phthisis goes with a well thickened and protective pleura, a small fistula, no effusion and a sound second lung, and he pointed out that in localized acute disease the prognosis can improve after rapid cavitation—a fact now ascribed to obstruction to the draining bronchus As with all the literature prior to the detection of the tubercle bacillus, we allow for some confusion between tuberculous and other chronic lung infections, but the book still

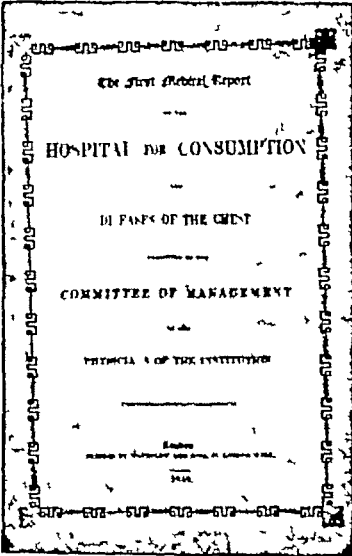


FIGURE 12

FIGURE 12 Title page of "The First Medical Report of the Hospital for Consumption and Diseases of the Chest" London, 1849

TABLE VIII
Showing the Occupations of 4,358 Patients labouring under Phthisis, treated as In and Out Patients from September 1842, to December 31 1848.

MALES—Total, 2,679					
In-Door		Out-Door		Mixed.	
Clerks, Warehousemen, and Shopmen ...	314	Labourers of various kinds ...	430	Carpenters ...	190
Mechanics ...	270	Cookmen and Cab-men ...	108	Painters and Glaziers ...	73
Servants ...	237	Barbers ...	15		
Tailors ...	192	Various occupations	184		
Shoemakers ...	187				
Printers and Compositors ...	104				
Weavers and Glovers ...	92				
Bakers ...	45				
Various ...	146				
None or under 15 ...	231				
Total In-door ...	1,888	Total Out-door ...	795	Total Mixed ...	196

FEMALES—Total 1,679					
In-door		Out-Door		Mixed.	
Servants, or persons engaged in in-door occupations ...	806				
Milliners, Dress-makers, Needlewomen, and Straw-bonnet Makers ...	312				
Laundresses ...	83				
Governesses ...	10				
No occupation, or under 15 ...	436				
Total In-door ...	1,679				

FIGURE 13

FIGURE 13 Table VIII from "The First Medical Report"

remains one of the classic works on its subject. There is more than one reason for regarding it as a neglected masterpiece.

The important contemporaries of Pollock at Brompton were Hutchinson, Edward Smith, William Marcet and John Burdon-Sanderson. Though they were all on the active clinical staff, it is to them that we owe the start of the experimental method as applied to respiratory function and disease—Hutchinson with spirometry, Smith with the chemistry of respiratory exchanges, Marcet with this and also his use of Villemin's discovery for diagnosing human pulmonary tuberculosis by animal inoculation with sputum, and Burdon-Sanderson in many ways. Burdon-Sanderson was incomparably the greatest, maybe of all the staff in the hundred years the most eminent for the sheer variety and extent of his original researches. They included elaborate papers on vegetable reproduction and on cattle plague, the invention of the kymograph, a fine paper on the relation between respiration and the pulse, and two fundamental studies of the excitatory process



FIGURE 14

FIGURE 14 Sir John Scott Burdon-Sanderson (1825-1905) (Cartoon by SPX from *Vanity Fair* May 17 1894 *Oxford Physiology*) —FIGURE 15 Fig 7 from *The Bronchi and Pulmonary Blood Vessels* by W Ewart London 1889 Showing casts of the bronchial tree



FIGURE 15
 FROM FIG. 7 OF *THE BRONCHI AND PULMONARY BLOOD VESSELS* BY W. EWART LONDON 1889
 SHOWING CASTS OF THE BRONCHIAL TREE

The specimen illustrates the structure in the walls of division of bronchi, the structure of their planes of bifurcation, the varied aperture of their angles, and their very open, cork-like infundibula at the periphery. Numerous branches and lobules are also seen. The upper vesicular spaces were probably supplied by numerous small, anastomosing to the corresponding air bronchioles from 1' certainly below the main angle of A. A good instance of Y-shaped bronchioles is to be noticed on the observer's right-hand side of the same specimen, in its upper part.

in cardiac muscle, using the capillary electrometer. Moreover, he was the first to confirm Villemain's work on the infectivity of tuberculosis for laboratory animals, investigated epidemics of cholera, cerebrospinal fever and diphtheria, made the first detailed experiments on artificial respiration in asphyxia by drowning, and did his famous studies of the sphygmograph soon after Marie's and wrote a book on them. None of his original work was directly clinical. His strength lay rather in his early grasp of the application of scientific methods to medicine, and in a superb technical skill. But, none the less, he worked for over ten years in the Out-Patient Department at Brompton, becoming one of the foremost advocates of sanatoria in their early days and of a proper system of supervision for tuberculous patients, and he spent the closing years of his life as Regius Professor of Medicine at Oxford, where he was succeeded by Osler. His position in English medicine is almost unique in that he was the first to bring the outlook of experimental physiology and to show in the profusion of his own investigations the rewards it was able to achieve. If one crucial test of a great mind is the quality of those it nurtures, Burdon-Sanderson can have few rivals, for among his associates and pupils were Sharpey, Ferrier, Waller, Mott, Rose Bradford, Osler, Victor Horsley, Romanes and Sidney Ringer.

Although Burdon-Sanderson was so eminent there must have

III-

BRONCHI AND PULMONARY

BLOOD VESSELS

*THEIR ANATOMY AND NOMENCLATURE;
WITH A CRITICISM OF PROFESSOR AIRY'S LIPPS ON THE
BRONCHIAL TREE OF MAMMALIA AND OF MAN*

BY

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FIGURE 16

Title page of "The Bronchi and Pulmonary Blood Vessels" by W Ewart London, 1889

been something greatly lovable about him. He was notoriously absent-minded. He used to stuff one chalk duster after another into his pockets when lecturing, and then clean the blackboard with his pocket handkerchief. One evening his wife left him to conduct guests into the dining room, but found him in the hall a few minutes later helping them into their overcoats, shaking hands and saying good-night. But perhaps the most amusing reminiscence is one of which he was the victim, concerning his appointment to the Brompton staff. His rival was a staunch adherent of the Church of England. Burdon-Sanderson was therefore questioned closely on his religious principles, and



FIGURE 17

FIGURE 17 William Ewart (1848-1929) Physician to St George's Hospital



FIGURE 18

FIGURE 18 Isaac Burney Yeo (1845-1914) (From 'Leaders in Medicine and Surgery, 1876' Barraud and Jerrard, London)



FIGURE 19

FIGURE 19 Sir James Kingston Fowler (1852-1934)

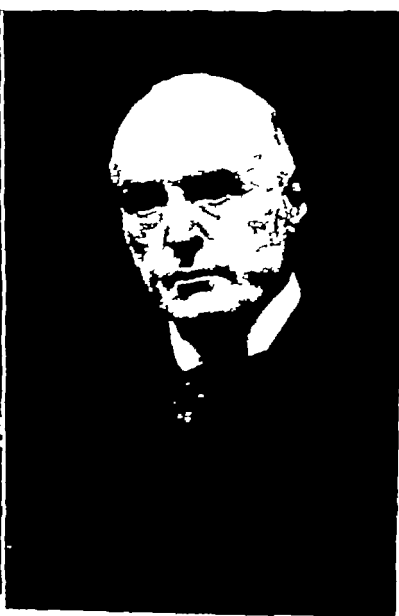


FIGURE 20

FIGURE 20 Sir Richard Douglas Powell (1842-1925)

required to get clergymen to testify to his orthodoxy before he was elected!

I have dealt at length with these early members of the Brompton staff because they planted the tree of thoracic medicine in England. True, it grew from the soil of Laennec, but they tended it wisely and well. The fruits of their work have been gathered ever since, and among those who have had the care of their legacy at Brompton were Douglas Powell, Burney Yeo, Charles Theodore Williams, Mitchell Bruce, William Ewart, Kingston Fowler, Percy Kidd, Hector Mackenzie, Sidney Martin, Batty-Shaw and L S T Burrell, not to mention others in succeeding years. We cannot here do more than touch upon a few of them. William Ewart, who did so much on bronchial anatomy, Burney Yeo, inventor of a simple inhalation face mask and one of the most lucid teachers of his day. How refreshing, for instance, to find the valueless use of potent remedies on hopeless cases trounced in this delightful fashion: "if ignorant charlatans wrote in this way, we should find no language too severe to condemn their imbecility. Gentlemen, this kind of thing is foolish trifling." Kingston Fowler, too, had a pointed style and his obiter dicta are replete with gusto and clarity—such remarks as "No fool is ever cured of pulmonary tuberculosis," "Once notified, always tuberculous," and "Strange things may happen when a clinician who has 'scrapped his stethoscope' calls in a radiologist who is not a pathologist." Kingston Fowler was a fine clinician, steeped in a knowledge of morbid anatomy, full of common sense and with an intuition trained by long and patient observation at the bed-side. He and Douglas



FIGURE 21 Sanatorium for Consumption and Diseases of the Chest, Bournemouth. From "The Annual Report of the Brompton Hospital, 1853"

Powell were, by all accounts, impressive figures and fine exponents of the art of managing both patient and disease

We have seen how Brompton already had a long record as a chest centre well before the close of last century The next step was sanatorium development Brehmer in 1859 and Trudeau in 1884 started sanatoria in Germany and America Actually Brompton decided in 1851 to build a small sanatorium at Bournemouth, and it was opened in 1854 This was, in point of fact, the first sanatorium But difficulties of travel for patients restricted its use to local cases, and, as time went by, Brompton found that another sanatorium was needed, nearer at hand A site was chosen on the Chobham Ridges, thirty miles from London, and in June 1904 Frimley Sanatorium was opened by the Prince and Princess of Wales It was designed for 150 patients accommodated on two stories in a stellate block, and had 65 acres of grounds

It was a fortunate day for Frimley when Marcus Paterson was appointed the first Medical Superintendent The work was new, the value of sanatorium treatment had still to be proven, and the lines on which that treatment should be conducted had still to be defined in detail Paterson extended the principle of graduated exercise to include useful labor The early trials were described in his book "Auto-Inoculation in Pulmonary Tuberculosis," and they formed the basis of the system which has been in use at Frimley ever since Though his views on the rationale of exercise were wrong—and there lie the roots of criticism—results soon



FIGURE 22 Brompton Hospital Sanatorium Frimley An aerial view

showed the value of work as an integral part of treatment. There is a story of a patient who discharged himself from the sanatorium rather than toe the line. As he left Paterson called out from his office, "Oh! by the way, tell your widow to send me a post-card."

Now we turn to more recent events. The growth of radiology completely changed assessment of the anatomical aspects of chest diseases. Blacker, the first radiologist at Brompton, was appointed in 1900, but it was the later combination of Stanley Melville and R. L. Rawlinson that brought the department to maturity. Many years ago they established the use of lateral and penetrating views of the chest, and of sinusography for the control of empyema drainage. They did much of the early work at bronchograms of high technical quality, and on the radiographic control of artificial pneumothorax and of surgical procedures. Neither Melville nor Rawlinson wrote much, and neither left an enduring monument to their work in words, but their knack of keeping close contact with the clinical staff, their insistence upon the importance of necropsy control of their findings whenever possible, and their standard of films and of interpretation were all ahead of their time for our country.

One feature at Brompton, prominent in the last twenty years, is the importance attached to careful training in breathing exercises for the restoration of functional efficiency in asthma and emphysema and after empyema drainage and other surgical procedures. Accurate techniques of postural drainage and of forced expiratory breathing and thoracic percussion were designed some years ago for treating septic bronchiectasis and some examples of lung abscess. Such treatment is essential for good results, whether as a pre-operative measure or as a routine for inoperable cases. The secrets of success are the accuracy of posturing in relation to the anatomy of the draining bronchi, and sufficiently prolonged posturing, often many hours daily at first.

But the most fruitful advances of recent times at Brompton, as in thoracic work elsewhere, have come from our surgical colleagues, whose mastery of technical problems claims the admiration of us all. There, Brompton may fairly claim that it has not only led the field in our country, but has maintained its lead with the largest and most varied thoracic surgical experience. The opening moves were due to J. E. H. Roberts and Tudor Edwards. In 1924 Tudor Edwards gave the first account in the English literature of thoracoscopic division of adhesions. By 1927 he reported the removal of seven intrathoracic new growths with only one death. Roberts started tourniquet lobectomies in 1931 using instruments of his own design for a modified Shenstone technique. He and Nelson published an account of 10 cases in 1933 and Tudor

Edwards and Price Thomas another 48 the following year Roberts and Tudor Edwards did the first two one-stage tourniquet pneumonectomies for bronchiectasis in the same week at Brompton, soon after Graham devised the operation for bronchial carcinoma. The first dissection lobectomy at Brompton was done by Tudor Edwards in April 1929 on a boy of sixteen, and the first dissection pneumonectomy by Price Thomas for a peripheral carcinoma in March 1935. Some idea of the volume of surgical work and its rate of increase may be gained from the fact that in 1939 Tudor Edwards reviewed 199 cases of bronchiectasis which he had treated surgically—166 lobectomies and 33 pneumonectomies. His experience with bronchial tumors was given in two fine papers in 1938 and 1946. The latter paper, published in the first issue of *Thorax*,



FIGURE 23 Arthur Tudor Edwards

was the opening Presidential Address to the Society for the Study of Diseases of the Chest which he founded shortly before his untimely death

I have brought this account to the present time and of necessity have been selective I have emphasized the early rather than the later history because the present place of Brompton in English Medicine derives from its record last century, not only in the sense of the achievement then, but also in the sense of the inspiration which that achievement still imparts If, moreover, I seem to have laid stress upon one aspect of the hospital—its place in the advancement of learning—I trust that I have not overlooked the reasons why we in England regard the Brompton with so much affection For it is, indeed, an atmosphere rather than an institution—a phrase by which Kingston Fowler once described a sanatorium Inherent in this atmosphere are regard for wisdom and respect for the past, though there is something more intimate than either of these Perhaps the words of Benjamin Disraeli at the Seventh Anniversary of the Hospital, almost a hundred years ago, were prophetic of this quality "It has been considered that consumption is an incurable disease All of us must feel that the secrets of nature cannot yet be told, and in an age distinguished as the present for the application of science to social life he is indeed a bold man who can say that he is to fold his arms in despair and sit down, and when he encounters a calamity can believe that a beneficent Providence which surrounds us has not supplied man with some remedial resource "

I am indebted to many friends and colleagues for help and guidance, in particular, to Mr Rouvray, Secretary to the Hospital, who generously placed his collection of documents and his expert knowledge of the subject at my disposal, to Mr Bishop, Librarian to the Wellcome Historical Museum, who enlivened our antiquarian researches and whose department did many of the fine illustrations, to Dr Maurice Davidson, who read the manuscript for me, to Dr J V Simpson, who collected much information towards it, and to Dr Foster Carter for some of the prints

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As there is no History of the Brompton Hospital, I have drawn upon original manuscripts, papers and letters, and upon contemporary accounts in the press for factual details Only accessible references to this part of the subject are given, and, for convenience, they are separated from the list of publications by members of the staff which have been consulted in preparing this paper

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Summary of Case Reports

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CASE NO 1 A colored female aged 24 years, was admitted in 1935 with protracted lympho-hematogenous tuberculosis with chronic pulmonary tuberculosis, tuberculous lymphadenitis, pericarditis and invasion of the myocardium. There was, in addition, dissemination to other viscera on autopsy examination. On serial x-ray films of the chest, the patient also presented very suggestive evidence of rupture of a caseous lymph node into a bronchus which was confirmed by necropsy.

CASE NO 2 A 32 year old white female, a contact case to her mother who died of tuberculosis was admitted to the hospital September 1946, largely on the basis of an x-ray film of the chest. The initial impression from the x-ray film was possible lymphosarcoma, Hodgkin's Disease, or Boeck's Sarcoid. Very soon after admission it became apparent on the basis of a rectal examination and biopsy of a rectal mass, that we were dealing with a primary adeno-carcinoma of the rectum with metastasis to the mediastinum and lungs. This was confirmed by postmortem examination. Metastases elsewhere were also found. It is interesting to comment here on the rapidity of the progress of the malignancy in this young adult patient and the fact that the roentgen film of the chest was not entirely characteristic of the classical picture of metastatic involvement.

CASE NO 3 The case of a 24 year old white soldier with a rather typical clinical history and serial x-ray evidence of primary pulmonary coccidioidomycosis was presented. Coccidioidin skin test was positive and the fungus was recovered on Sabouraud's glucose agar medium. The roentgen residue of the pulmonary process was represented by a productive linear infiltrate in the upper portion of the left lung, which by itself could be readily misinterpreted as tuberculosis.

CASE NO 4 The case of a 37 year old white soldier was shown who had a post-pneumonic staphylococcal empyema which was treated by combined penicillin therapy (intramuscularly and intrapleurally) in conjunction with repeated pleural lavage with sterile normal saline solution. Cure of the empyema was obtained with obliteration of the pleural space and re-expansion of the lung with residual pleural thickening. The final roentgen appearance of the re-expanded lung was comparable to that which could have been achieved by thoracotomy. This case was presented as an example of what may sometimes be achieved by the above method. In some selected cases of empyema, but is by no means the preferred treatment in the vast majority of pyogenic empyemas. Surgical drainage is still the basic therapy.

*Case reports presented at a meeting of the New Jersey Chapter, American College of Chest Physicians, Berthold S. Pollak Hospital for Chest Diseases, Jersey City, N. J., January 27, 1948.

CASE NO 5 A white male, aged 63 years, was admitted August 1947, and discharged December 1947 His chief complaint was that of repeated hemoptyses of fair amounts of bright red blood His sputa were negative except for one which showed tubercle bacilli on cultures Subsequent cultures were negative The roentgenogram of the chest showed the entire right apex to be occupied by a rarefied shadow which strongly simulated a large emphysematous bulla Bronchoscopy revealed frank blood to be coming from the right upper lobe bronchus and the bronchial opening was free of any growth Patient came to operation undiagnosed The lobe was removed and on section it was found to be occupied by a large abscess cavity due to destruction of the lobe by carcinoma

CASE NO 6 A white female, aged 19 years, admitted May 1947, discharged July 1947 Chief complaint, productive cough and hemoptysis Exposed to an aunt who had tuberculosis In the past she had had frequent colds Sputum was persistently negative Roentgenogram of the chest showed a minimal lesion of the right 2nd interspace which was diagnosed tuberculous in view of the history of contact and the symptoms Culture of sputum over a period of 24 hours, however, showed 4 ozs of mucopurulent sputum which was non-odorous Further investigation revealed moderately coarse rales along the left para-vertebral region in the lower half of the chest About 10 days after admission fluoroscopy showed the bronchopneumonic infiltrate along the left cardiac margin and patient was placed on penicillin aerosol to which she responded very favorably by subsidence of sputum and resorption of the bronchopneumonia Subsequent bronchography revealed a cylindrical bronchiectasis of the left lower lobe Lobectomy was performed

CASE NO 7 A white female, 46 years of age, admitted December 1946, discharged March 1947 Chief complaint was that of loss of weight and weakness Transferred from the General Hospital where she had been treated for a pneumonia Roentgenogram of the chest revealed a more or less circumscribed round density in the right upper lobe and a few minute calcified spots in the apex Gastric washings were negative for tubercle bacilli Explored with a pre-operative diagnosis resting between tuberculoma and malignancy At operation a large tuberculoma was found, the lobe was removed and patient treated postoperatively with streptomycin She made an uneventful recovery

CASE NO 8 A white male, aged 66 years, admitted January 27, 1947 and expired February 5, 1947 Niece case of pulmonary tuberculosis but no other contact On January 18, 1947 he developed sudden weakness, fever and chills These symptoms were shortly followed by cough and hemoptysis On admission examination he revealed the following Blood pressure 170/100, pulse rate 100 but regular, loud blowing systolic murmur in the mitral area Temperature 104° Liver enlarged and had pretibial edema and was jaundiced Roentgenogram of the chest showed a mottled infiltrate extending from both hilae peripherally to the mid-lung fields Laboratory studies to determine the cause of the jaundice revealed a hepatogenous form of icterus The premortem diagnosis rested between three possibilities 1) Acute tuberculosis, 2) Lymphogenous metastatic infiltration, 3) Cardiac failure with pulmonary congestion

At autopsy hematogenous tuberculosis was found with dissemination to the various organs, particularly the liver which was loaded with tubercles

Editorial

THE SPECIALTY OF CHEST DISEASES

We have been witnessing an unprecedented expansion of scientific information pertaining to internal medicine during the past few decades. The accumulation of newly acquired scientific data has led to a crystallization and acceptance of new branches of this specialty. Thus, cardiology, gastro-enterology, endocrinology and allergic diseases have been recognized as subjects to which full-time training and devotion are to the best interest of the patient.

For some years, there has been a growing consciousness in medical circles of the importance of specialized training in *chest diseases*. Since its inception, the American College of Chest Physicians has championed this issue. The founders of this organization had the vision in focusing their efforts on the need of thorough education in this particular field. Though new paths in science are always hard to break, unrelenting endeavors and undaunted conviction by the Fellowship of the College brought about welcome results.

The brilliant achievements of a concerted organized campaign directed toward the eradication of tuberculosis should serve as an example of what can be attained by intelligent approach to the prevention and treatment of human disease. While recognizing the bearing of socio-economic factors on this problem, it cannot be disputed that the application of intensified and improved methods of prevention and treatment as carried out by the medical profession have had a cardinal role in the remarkable results accomplished. It is with justifiable pride to say that through better and greater medical service, the tuberculosis mortality rate has been reduced by nearly two-thirds during the past quarter of a century.

There are a number of other *chest diseases* which should challenge the ingenuity and determination of progressive-minded physicians. Diseases of the various organs and structures of the chest represent a large enough group and a complexity of problems to completely engage the talent and ability of interested physicians. Competence and efficiency in handling these conditions are more readily acquired when studied as interrelated items. The very nature of the close anatomic and functional connections between the organs potentially involved implies that only through a correlated understanding of each problem is it possible to diagnose and treat *diseases of the chest*.

The task ahead of us is a tremendous one. Its ramifications reach from acute and chronic nontuberculous bronchopulmonary infections to allergic manifestations in the respiratory tract, to neoplasms, congenital malformations, circulatory failure, emphysema and other conditions. Acute and chronic illnesses, invalidism and disabilities resulting from them represent not only much suffering but also incalculable economic loss to the patient as well as to the community. It can be stated, that by the early application of modern diagnostic and therapeutic methods much can be done for shortening the course of some of these diseases and—what is even more significant—for obviating the misery of chronic incapacitation and for saving the community millions of productive working days every year.

Let us examine some pertinent facts. At the 1947 annual meeting of

the College, Rienhoff reported on a group of 327 cases of primary bronchogenic carcinoma. According to his clinical observations, 66 per cent of these patients were admitted to the hospital with tumors already in the inoperable stage. Assuming that the same situation holds true of other large public institutions, these findings are certainly startling and tragic. At the same time, they serve to explain why approximately 16,000 individuals die of this single cause each year. Is it not time to begin combatting this state of affairs? The reported yearly increase in primary bronchogenic carcinoma only adds emphasis to such endeavor. No doubt, a new orientation as to the diagnosis of this condition is in order. If diagnosis is delayed until local or constitutional symptoms bring the patient to the physician, in a great many instances the life of the patient with primary bronchogenic carcinoma cannot be saved. This being so, the practicing physician as well as the coming generation of medical men should bear in mind that searching for carcinoma in the apparently healthy is more likely to lead to its early discovery and curability than waiting until symptoms of the disease develop.

We are approaching an era when we will be called upon more and more often to make diagnosis of subclinical rather than clinical conditions. Relative to primary carcinoma of the lung, x-ray examination of the chest, searching for malignant cells in the bronchial secretions, bronchoscopic intervention and other accessory examinations are invaluable means for the early discovery of bronchogenic carcinoma. Qualified private physicians should be able to equal or even exceed the results of mass x-ray surveys of large blocks of the population. These surveys have proved that early discovery of tuberculosis as well as non-tuberculous conditions of the chest is a reality. So is modern thoracic surgery. With the combination of these two, the prospective reduction of the regrettably high mortality rate of pulmonary cancer is not a "Utopian Dream." Of course, one of the prerequisites of such success is the acquisition of special training in *chest diseases*.

Other instances where expert management of the sick may forestall serious consequences are pulmonary diseases which may lead to bronchiectasis. It is beyond the scope of this discussion to deal with the mechanics of the development of this disease. Suffice it to say that a great variety of pathologic changes in the bronchi and the lung parenchyma may be the direct or indirect source of bronchial dilatation. The death toll of bronchiectasis is not as familiar to the medical profession as it ought to be. Bonniot (1936) reported that one-third of children with bronchiectasis died in from two to three years. Perry and Kling (1940) concluded from the analysis of their cases in whom bronchiectasis developed before the age of ten years that 65 per cent were dead within twenty years and 90 per cent within thirty years. These appalling figures should have no place in our times. During the past few years, tremendous advances have been made in the medical and surgical management of this disease. On the basis of experience with modern therapeutic methods, it is reasonable to predict a radical improvement in the life expectancy and symptomatic amelioration of these patients, provided of course, that adequate measures are applied early and selectively. Even where surgical intervention is not indicated, a great deal may be achieved by conservative means. It is possible to completely eliminate the bronchial infection by chemotherapy, antibiotics and mechanical relaxation measures. We are confident that recent trends in medical training will effectively cope with this problem.

One could go on and on enumerating chest conditions in which a wider application of known facts and methods would bring about improvement in therapeutic results. For instance, a great many victims of emphysema represent such a group. Industrial medicine is in crying need of the services of men well trained in *chest diseases*. Prevention, diagnosis and treatment of diseases of the cardio-respiratory organs call for much more qualified physicians in this field than are available at the moment. Silicosis is only one of the pneumoconioses. Men are exposed to the massive inhalation of silica in a wide variety of occupations, such as mining, foundry work, pottery, granite cutting, abrasive soap manufacturing, spray-coating and others. More and more recognition is given to the fact that silicosis is not merely pulmonary fibrosis but it is commonly associated with emphysema. The latter may be microscopic or grossly evident. In any event, it adds to or aggravates the patient's actual or potential disability. The possible development of failure of the right ventricle and complicating tuberculosis are no small items in the fate of the individual with silicosis. These are satisfactory methods for the recognition of the disease itself as well as of its complications. Why not provide adequate medical service for these persons through specialized training?

Methods for estimating cardiac insufficiency are generally accepted in clinical practice. The same cannot be said about pulmonary function tests. There is no reason why this lag should exist. Since the pioneering work of Jacobaeus (1936) with bronchspirometry, estimation of the function of the right and left lung separately has become practicable. The technique of this procedure can be readily acquired. Bronchspirometry is of great help in determining the degree of disability which may arise from emphysema, pneumoconiosis and decompensated heart disease associated with pulmonary congestion. Occasionally, medico-legal issues may be clarified with the aid of this method. Also, an equitable decision may be brought in questions of industrial disability and in determining the liability of insurance carriers in certain types of acute or chronic pulmonary diseases. Hurtado and Fray (1933), Cournand and his associates (1939, etc.) and others have contributed substantially to the development of suitable methods for estimating pulmonary function. All these are of value in assaying the respiratory capacity and work tolerance of the individual with certain diseases of the lung. Versatility with these methods is mandatory as far as modern practice of *chest diseases* is concerned. Among other valuable diagnostic methods, mention should be made of tomography, roentgen kymography, angiocardiography and catheterization of the heart for functional measurements. There is a growing demand for these specialized services. Simultaneously there is an increasing recognition of the need for thorough training in *chest diseases*.

In this connection, it should be mentioned that *chest diseases* as a specialty have been given emphatic recognition in the unanimous approval by the House of Delegates of the American Medical Association at Atlantic City in June 1947 whereby a Section on Diseases of the Chest has been established as part of the scientific program of each annual meeting of the American Medical Association. In accordance with this splendid resolution a highly interesting scientific program on *chest diseases* has already been arranged for the coming annual convention of the American Medical Association which is to be held at Chicago in

June 1948 It is ardently hoped that a large registration at this new section will vindicate its usefulness to the medical profession

As another interesting item concerning *chest diseases*, it is gratifying to note in the December 20, 1947 issue of The Journal of the American Medical Association the listing of postgraduate courses for the period January 1, to July 15, 1948 In it, the heading "Chest Diseases" is prominently displayed Heretofore, postgraduate courses in chest diseases were listed under tuberculosis and, more recently, under pulmonary diseases The term "chest diseases" is broad enough to cover all pulmonary diseases, including tuberculosis

In the aforementioned listing, courses limited to pulmonary diseases and tuberculosis are listed under the main heading of *Chest Diseases* The specialty of *chest diseases* has finally come into its own and is receiving its proper recognition from medical societies other than the College The Fellowship of the American College of Chest Physicians and the Editorial Board of *Diseases of the Chest* are grateful to the Council on Medical Education and Hospitals of the American Medical Association for clarifying this situation

A L B

TUBERCULOSIS ERADICATION BEING ACHIEVED

In this issue of *Diseases of the Chest*, Dr Jordan presents the most effective demonstration of tuberculosis control that has ever been reported He has even gone beyond control to eradication Beginning in 1930 he developed a program based on fundamental methods Starting with the premise that tuberculosis is contagious, he proceeded to prevent the dissemination of tubercle bacilli from humans who were eliminating them and to assist the veterinarians at every opportunity in the eradication of tuberculosis from cattle His eight-point program has omitted nothing of importance and, therefore, it is an ideal procedure which can and should be adopted everywhere The efficaciousness of Dr Jordan's program has been proved beyond the shadow of a doubt The only method of determining the effectiveness of a tuberculosis control program is periodic tuberculin testing of all children born since the work began and comparing the findings with those previously established If tuberculosis control work is effectively prosecuted the chances of children developing primary tuberculosis (tuberculous infection) should decrease from year to year through the removal of contagious cases in humans and animals from the environment and preventing others from becoming contagious Wherever such a program is in operation one might expect soon to see all children of one year of age without contamination with tubercle bacilli and therefore nonreactors to tuberculin This means eradication of tuberculosis at this age level With the continued protection of these children, as well as those subsequently born, the age level at which tuberculosis is eradicated obviously increases from year to year

In the past such an accomplishment may have seemed highly theoretical and speculative to many physicians engaged in tuberculosis work Regardless of anyone's previous opinion, every physician must now disabuse his mind of the idea that tuberculosis cannot be eradicated in this manner Dr Jordan has proved the point He began in 1930, when 14 per cent of the school children in his four-county district were found to have primary tuberculosis (tuberculous infection) In 1946 and 1947, only

2.5 per cent of the children in these same schools had this disease. In fact, of the 277 schools under consideration there were 219 in which no child had primary tuberculosis as manifested by the tuberculin reaction. *This means eradication of tuberculosis at the school age level in these 219 schools*—an accomplishment apparently never before reported. The chances of children becoming infected in this environment subsequently are extremely slight. Therefore, if the present program continues one might expect the majority of them to live out their lives without the hazards of tuberculous infection.

On numerous occasions in the past, persons became over-enthusiastic and launched slogans such as "No Tuberculosis by 1920", "No Tuberculosis by 1960", "No Tuberculosis by the Year 2000", "No Tuberculosis In Our Time," etc., etc. Obviously those who prepared and publicized such slogans had not carefully analyzed the situation. Apparently they overlooked the fact that some healthy-appearing children who reacted to tuberculin and therefore had live tubercle bacilli containing lesions in their bodies would have living descendants of these organisms for decades or as long as they lived.

Even if all infection were to stop today tuberculosis could not possibly be eradicated by the year 2000. There are now infants and young children with primary lesions who will only be approximately 53 years of age when the year 2000 arrives. Among them are sure to be some whose lesions contain the progeny of tubercle bacilli now present. Some such persons in this age period will through endogenous reinfections develop clinical lesions after the year 2000. However, by that time tuberculosis eradication would be realized among all persons of 53 years or younger and in Dr Jordan's district of 68 years or younger. Therefore in the year 2000 it would be necessary to keep under close observation, only those beyond these ages.

Obviously, in Dr Jordan's district there is considerable residual tuberculosis, largely in the form of primary lesions in the bodies of the older citizens who were not protected against infection in childhood or early adulthood. However, this number is not as great as one might suspect. This is because some persons were never infected, whereas, in others the tubercle bacilli have vanished, and therefore they are nonreactors to tuberculin. The exact percentage of older persons with tubercle bacilli still alive in the lesions of the primary complexes is not known. It could be accurately determined by testing all adults. In fact, Jordan states that of 3,698 teachers and other personnel members of the schools ranging from 21 to 71 years, only 21.6 per cent reacted to tuberculin.

Whatever the number of adults who now have living tubercle bacilli in their bodies, the main problem of the future consists of keeping these persons under close observation so that those in whom lesions evolve to clinical proportions may have them detected before they become contagious and when they are readily treatable. This will keep liberated tubercle bacilli from the environment of the children and thus the age level at which the disease is eradicated will increase from year to year.

Dr Jordan's demonstration is the first in the world to prove conclusively that tuberculosis can be eradicated from humans. All theoretical considerations were eliminated and only well-established, fundamental procedures were employed. To conduct such a program requires a great deal of work, but it is the only known method of attaining the ultimate goal—eradication.

Fourteenth Annual Meeting

AMERICAN COLLEGE OF CHEST PHYSICIANS

Congress Hotel, Chicago, Illinois

JUNE 17 - 20, 1948

PRELIMINARY PROGRAM

THURSDAY, JUNE 17

Oral and Written Examinations for Fellowship
Executive Council Meeting
Board of Regents Meeting
Board of Governors Meeting
Council and Committee Meetings

FRIDAY, JUNE 18

9 00 - 12 00 *Session No 1*

Moderator Dr Edwin R Levine, Chicago, Illinois

Speakers Dr Francisco Torres, et al, Cordoba, Argentina,
"Pulmonary Resection in Tuberculosis"
Dr Charles P Bailey, Philadelphia, Pennsylvania,
"Lung Resection in Tuberculosis"
Dr George Wright, Saranac Lake, New York,
"Effect of Disease on Pulmonary Physiology"
Dr George Ornstein, New York City,
"Pulmonary Function"

2 00 - 5 00 p m *Session No II*

Moderator Dr Richard H Overholt, Brookline, Massachusetts

Speakers Dr Irving Sarot, New York City,
"Enucleation Technique for Lung Containing Adhesions"
Dr Karl Poppe, Portland, Oregon,
"Treatment of Aortic Aneurysms"
Dr Willis J Potts, Chicago, Illinois,
"Recent Advances in Intrathoracic Vascular Surgery"
Dr O T Clagett, Rochester, Minnesota,
"Surgical Treatment of Giant Bullous Cysts"
Dr Evarts A Graham, St Louis, Missouri,
"The Problem of Cancer of the Lung"

SATURDAY, JUNE 19

10 30 - 12 00 *Session No III* — X-ray Conference

Dr L H Garland, San Francisco, California

Physicians wishing to participate in the X-ray Conference, please refer to page xiv for instructions regarding films to be submitted

2 00 - 4 30 p m *Session No IV* — Symposium on BCG

Moderator Dr Francis J Weber, Washington, D C
(Titles to be announced)

SUNDAY, JUNE 20

9 00 - 12 00 *Session No V*

Moderator Dr Andrew L Banyai, Milwaukee, Wisconsin

Speakers Dr Marcio Bueno, New Bedford, Massachusetts,
"Diagnostic Bronchial Lavage in Tuberculosis"

Dr George N Papanicolaou, New York City,
 "Diagnosis by Sputum Examination "

Dr Seymour M. Farber, San Francisco, California
 "Cytologic Diagnosis of Primary Carcinoma of Lung by
 Means of Sputum and Bronchial Secretions "

Dr Maurice M Black, Brooklyn, New York,
 Blood Diagnosis of Cancer "

Dr Andres Soulas, Paris, France,
 "Study of Bronchial Stenosis in Bronchopulmonary
 Tuberculosis "

2 00 - 5 00 p m Session No VI

Moderator Dr Harry C Warren San Francisco, California

Speakers Dr Walter Nalls, Oteen, North Carolina,
 'Diet in Treatment of Tuberculosis "

Dr Allan Hurst, Denver, Colorado,
 "Psychologic Problems in Tuberculosis "

Dr Italo Volini Chicago, Illinois,
 Treatment of Pneumonia with Penicillin in Oil
 (Romansky) "

Dr Maurice Segal, Boston, Massachusetts,
 'Facts and Fancies in Management of Bronchial Asthma "

NOTE The Committee on Scientific Program of the College has
 arranged the above program so that there will be ample
 time for discussion from the floor

ANNUAL BANQUET, 7 30 p m , Saturday June 19

LUNCHEON MEETINGS

Thursday, June 17 Annual Conference of College Chapter Officials

Friday, June 18 Annual Conference of Medical Directors and Super-
 intendents of Tuberculosis Hospitals and Sanatoria

Saturday, June 19 Council on International Affairs
 Council on Pan American Affairs
 Council on European Affairs
 Council on Pan Pacific Affairs

Sunday, June 20 Annual Conference, Council of Tuberculosis Com-
 mittees

NOTE The Annual Convocation will be held at 6 00 p m., Saturday,
 June 19

Physicians in foreign countries have been invited to participate in
 the program and their names and subjects will be published in the
 next issue of *Diseases of the Chest*

SESSION ON DISEASES OF THE CHEST SCIENTIFIC ASSEMBLY AMERICAN MEDICAL ASSOCIATION JUNE 24 1948

OFFICERS

Richard H Overholt, M.D
 Brookline, Massachusetts
Chairman

J Winthrop Peabody, M.D
 Washington, D C
Secretary

SYMPOSIUM ON STREPTOMYCIN

Dr Emil Bogen Los Angeles California
 Laboratory Aspects of Streptomycin "

Dr H C Hinshaw Rochester, Minnesota,
 'Streptomycin in Extrapulmonary Tuberculosis "

Dr Karl H Pfuetze, Cannon Falls, Minnesota,
"Streptomycin in the Treatment of Tuberculosis "

Dr William Tucker, Minneapolis, Minnesota,
"Experience with Treatment of Various Forms of Tuberculosis with
Streptomycin in the Veterans Administration "

Dr Brian B Blades, Washington, D C ,
"Use of Streptomycin in Surgical Patients "

Dr Chester Keefer, Boston, Massachusetts,
"Antibiotics in Relation to Non-Tuberculous Chest Disease "

Report of Council on Public Health

The Council on Public Health of the American College of Chest Physicians met in Baltimore at 3 00 p m on Monday, November 24, 1947 The ensuing discussion centered mainly about the nation-wide case-finding program for tuberculosis This program is being extended every day and a certain cut pattern has begun to emerge, a pattern which is the result of several years of experience in this field Moreover, it is the opinion of the Committee that the overall pattern which has been developed is a successful and worthy one Therefore, the Council feels that the Tuberculosis Control Division of the U S Public Health Service should continue its present activities in that field with a view toward covering the whole nation in its case-finding program It is believed that certain phases of this activity deserve particular attention with a view toward seeing that (1) case-finding is carried out among all persons admitted to the out-patient and in-patient departments of hospitals, especially general hospitals, (2) private practitioners, to an increasingly extent, encourage x-ray examination of the chest of all patients encountered in private practice, (3) community-wide surveys of the adult population should be undertaken wherever practicable, and (4) other special groups such as industrial groups should be encouraged to take an active role in special case-finding activities

Since such chest x-ray case-finding programs will develop a need for a great deal of follow-up, not only for cases of tuberculosis but for other chest conditions found as a result of such examinations, it is obvious that a great deal of special knowledge will be necessary on the part of physicians participating in diagnostic follow-up It was felt that the membership of the American College of Chest Physicians is in a unique position to lend the medical assistance that is needed in this follow-up program Much can be done toward promoting post-graduate training of physicians in chest diagnosis, acquainting them with the proper follow-up procedures to be carried out Some of this is already being done in the regular postgraduate courses of the College A great deal more of this medical assistance is needed in the way of additional courses and also in putting an educational program on chest diseases into effect through local medical societies

In order to make any tuberculosis control case-finding program effective, it will be necessary to insure minimum follow-up services in terms of quality and quantity

Paul A Turner, M.D
Louisville, Kentucky, *Chairman*

College Chapter News

ARGENTINE CHAPTER

At the Second Annual Meeting of the Argentine Chapter, which was held at "Tigre," Cruz Colorada on December 8, 1947, the following officers were elected for the year 1948

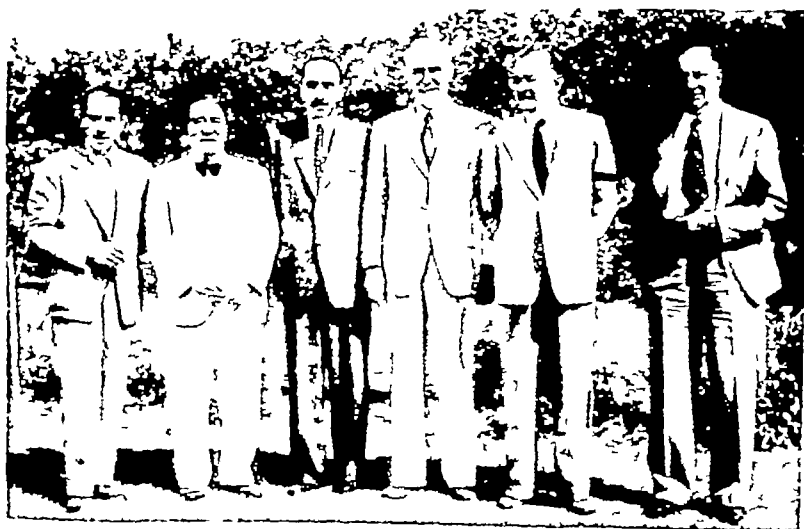
Dr Agustin Caelro, Cordoba, President

Dr Justo Lopez Bonilla, Rosario, Vice-President

Dr Angel N Bracco, Buenos Aires, Secretary-Treasurer

A scientific program was presented as published in the January-February issue of the College journal, which was followed by a luncheon meeting Dr Chevalier L Jackson, Philadelphia, Pennsylvania, Chairman of the Council on Pan American Affairs of the College was guest speaker at the luncheon Dr Raul F Vaccarezza, Buenos Aires, Governor of the College for the Argentine, and past-president of the Argentine Chapter, delivered a report of the activities of the chapter during the year 1947 and made special mention of the visit to the Argentine of Dr Richard H Overholt, Brookline Massachusetts, President-Elect of the College, and Mr Murray Kornfeld, Executive Secretary Dr Vaccarezza then introduced Dr Jackson and spoke highly of the excellent organization established in the Latin American countries through the efforts of Dr Jackson and the members of his Council Dr Jackson responded with

*Second Annual Meeting Argentine Chapter
American College of Chest Physicians
"Tigre" Cruz Colorada, December 8, 1947*



Left to right Dr Angel N Bracco Buenos Aires, Secretary-Treasurer, Argentine Chapter, Dr Gumersindo Sayago, Cordoba, Regent of the College, Dr Agustin Caelro, Cordoba, President, Argentine Chapter, Dr Raul F Vaccarezza, Buenos Aires, Governor of the College, Dr Justo Lopez Bonilla Rosario Vice-President Argentine Chapter and Dr Rodolfo A Vaccarezza, Buenos Aires, Fellow of the College

a report of the aims and purposes of the Council on Pan American Affairs of the College and expressed his appreciation to the officers and members of the Argentine Chapter for their excellent cooperation in the College program and for their splendid hospitality Dr Gumersindo Sayago, Cordoba, Regent of the College for the Argentine, was present for the meeting and took part in the scientific program

CALIFORNIA CHAPTER

The California Chapter of the College will hold its annual meeting in San Francisco on April 10, 1948 Jane Skillen, M.D, F C C P, Olive View, California, Chairman of the Program Committee for the meeting has announced the following tentative program

"Streptomycin in Laryngeal Tuberculosis,"

Bernard Margulies, M D

"Mediastinal Tumors,"

Thomas Wiper, M.D, F C C P

"Carcinoma of the Oesophagus,"

Lyman A Brewer, III, M D, F C C P

"Indications for Pulmonary Resection in Bronchiectasis,"

Paul Sampson, M.D, F C C P

"Q Fever,"

R J Huebner, S.A, Surgeon, USPHS

"Home Treatment of the Tuberculous Patient,"

William Kinney, M.D, F C C P

Other members of the Program Committee are Cabot Brown, M.D, F C C P, San Francisco, Gordon A Diddy, M D, F C C P, Ahwahnee, William A Kinney, M D, F C C P, Riverside, and David T Proctor, M.D, F C C P, Pasadena, California

CENTRAL BRAZILIAN CHAPTER

The Central Brazilian Chapter of the College met in Rio de Janeiro on November 20, 1947 Due to the absence of the President, Professor Mazzini Bueno, Dr Reginaldo Fernandez, Governor of the College for Central Brazil, acted as Chairman and Dr MacDowell Filho acted as Secretary Dr Fernandes invited the following doctors to sit at the head table

Professor Affonso MacDowell, Regent of the College for Brazil

Dr Alberto Renzo, Director of Division of Tuberculosis in the city of Rio de Janeiro

Dr Francisco Gugliotti, Superintendent of the Sao Sebastiao Sanatorium

Representative Dr Odilon Soares, member of the Public Health Commission of the Brazilian Congress

Professor Hugo Pinheiro Guimaraes, Vice-President of the Central Brazilian Chapter

Dr Galdino Travassos, President of the Brazilian Tuberculosis Society

Professor Antonio Ibiapina, Professor of Tuberculosis of the Medical and Surgical School

Dr Flavio Fraga, Superintendent of the Santa Maria Sanatorium

The City of Niteroy was chosen for the next meeting of the Central Brazilian Chapter By suggestion of Dr Fernandes, the Central Brazilian Chapter expressed regret regarding the recent death of Dr Rafael

Pardelas, who was one of the founders of the Brazilian Tuberculosis Society

Two subjects were discussed at the meeting. The first was "Tuberculosis Empyema" and papers on this subject were read by Drs C Branco, S R Barboza and Murga Jr, from the Miguel Pereira Hospital, Dr Jesse Teixeira, et al, from the Santa Maria Sanatorium, Drs Ugo P Guimaraes and H F Magaras from the Sao Sebastiao Sanatorium. Drs J Amello and J S Vizella from the Azevedo Lima Sanatorium. The papers were discussed by Drs A Renzo and M Lobato.

The second subject was "Tuberculosis and Pregnancy" and papers on this subject were presented by Drs F Magarao, H Linhares and A Vieira from the Central Laboratory, Tuberculosis Division, City of Rio de Janeiro, and by Dr Roberto Simonard from the N S das Dores Hospital. Discussions followed by Drs A MacDowell, A Vieira, L Dias, A Ibiapina and U P Guimaraes.

Following the scientific session the Secretary of the Chapter, Dr Affonso MacDowell Filho presented his report. He gave a brief summary of the history of the College. Four meetings are planned for 1948, the first one to be held during the last week of March. That meeting will be held in the Azevedo Lima Sanatorium, City of Niteroy, State of Rio de Janeiro. For future meetings three subjects are planned for discussion: (1) Non-tuberculous suppurations of the lung, (2) diagnosis of activity in minimal pulmonary tuberculosis, (3) results of collapse therapy.

Dr Gugliotti, the superintendent of the hospital thanked those present for their choice of his institution for the meeting. To close the session, Dr MacDowell, the Regent of the College, congratulated those present for the success of the meeting and thanked the hospital for their fine reception. (A photograph of the officials of the Central Brazilian Chapter was published in the January-February, 1948 issue of 'Diseases of the Chest')

NEW JERSEY CHAPTER

The New Jersey Chapter of the College will hold its annual meeting at Haddon Hall, Atlantic City in connection with the annual meeting of the Medical Society of New Jersey, April 26-29, 1948. The program for the meeting has been included as a Section on Chest Diseases in the Scientific Assembly of the state medical society and will be presented on Wednesday, April 28. John E Runnells, M.D. F.C.C.P., Scotch Plains, and Homer H Cherry M.D. F.C.C.P. Paterson, were appointed Chairman and Secretary-Treasurer, respectively of the Section. The program to be presented is as follows:

Streptomycin in the Treatment of Tuberculosis,"

Carl Muschenheim, M.D., New York, New York

Discussion opened by Samuel Cohen, M.D., Jersey City, New Jersey

"Non-Tuberculous Pulmonary Infections Complicating Pulmonary Tuberculosis,"

Otto S Baum, M.D., F.C.C.P. South Orange, New Jersey, and

Lewis F Baum, M.D., F.C.C.P., South Orange, New Jersey

Discussion opened by Irving Willner, M.D., F.C.C.P., Newark, N J

"Aerosol Antibiotic Therapy in Suppurative Diseases of the Lungs and Bronchi"

Benjamin P Potter, M.D., F.C.C.P., Jersey City, New Jersey

Discussion opened by Paul K Bornstein, M.D, F C C P, Asbury Park, New Jersey

The New Jersey Chapter met at the Berthold S Pollak Hospital for Chest Diseases, Jersey City, on January 27 The scientific session was preceded by an executive meeting with all of the members of the Executive Committee attending The scientific session consisted of the presentation of cases by Samuel Cohen, M.D, and B P Potter, M.D, F C C P, Jersey City, and Eli Rubin, M.D, F C C P, New York City, acted as moderator A summary of these case reports can be found on page 298 of this issue of the journal

OHIO CHAPTER

The Ohio Chapter of the College will hold its annual meeting at the Hotel Gibson, Cincinnati, on Wednesday, March 31 There will be a luncheon at 12 00 noon for College members and guests Following this, a scientific program will be presented

"Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis,"
Myron M Perlich, M.D, Cleveland, Ohio

"Primary Tuberculosis Evaluation and Criteria for Hospitalization,"
Samuel L Painter, M.D, Cincinnati, Ohio

POTOMAC CHAPTER

The Potomac Chapter of the College will hold its annual meeting at the Sheraton-Belvedere Hotel, Baltimore, Maryland on April 26 The following program is to be presented in an afternoon session

"Modern Concepts in the Surgical Treatment of Pulmonary Suppurative Diseases,"

Walter Crandell, M.D, White River Junction, Vermont

"Use and Abuse of Pneumothorax,"

John Hayes, M.D, Saranac Lake, New York

"Resection in the Treatment of Pulmonary Tuberculosis,"

Otto C Brantigan, M.D, F C C P, Baltimore, Maryland

"Coronary Disease and Its Complications,"

C Edward Leach, M.D, Baltimore, Maryland

Following the scientific session there will be a business meeting, and a cocktail party and dinner will be held in the evening

PUERTO RICO CHAPTER

The Annual Meeting of the Puerto Rico Chapter of the American College of Chest Physicians, was held on December 11-12, 1947, in conjunction with the Annual Convention of the Puerto Rico Medical Association at San Juan, P R During the Administrative Session, held on December 11, the following members were present Drs Jaime F Pou, A Acosta Velarde, H Marrero Otero, Ramon T Colon, Alice Reinhardt, Luis A Passalacqua, J de Lara, Leandro Santos, Rafael Velazquez, August Toretelli, Miguel Alonso, David Garcia, David Rodriguez, Jose Pico, Jose Soto Ramos, Fernando L Buxeda, and Juan Manuel Moscoso Cordero

Dr J M Moscoso Cordero, Governor of the College for the Dominican Republic was present as an official guest during the Convention

The officers for the Chapter during 1947 were re-elected for the year 1948

Dr Jaime F Pou, President

Dr Jose A. Amadeo, Vice-President

Dr Fernando L Buxeda, Secretary-Treasurer

The following officers were elected to the Board of Directors for the year 1948

Dr Jose Soto Ramos

Dr Juan H Font

Dr Rafael Velazquez

Dr Luis A Passalacqua was nominated to succeed Dr David Garcia as Regent of the College for Puerto Rico, subject to the approval of the Board of Regents when the College meets for its Fourteenth Annual Meeting in June, 1948 Dr Angel M Marchand was recommended as Governor of the College for Puerto Rico

Following the administrative session, a luncheon was held at the Zero Club, Santurce, P R

On December 12th, the Scientific Session was held and the following papers were presented

"The Present Status of BCG Vaccination "

Dr Juan Manuel Moscoso Cordero

"Streptomycin Therapy in Pulmonary Tuberculosis,"

Dr E Martinez Rivera

"Pulmonary Changes in Mitral Strictures,"

Dr J Soto Ramos

"Bronchiectasis" (followed by moving pictures of a lobectomy for bronchiectasis performed by Dr David Rodriguez),

Dr David Rodriguez

"Phrenic Nerve Paralysis and Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis,"

Dr Gustavo Bergnes Duran

"Streptomycin Therapy in Genito-urinary Tuberculosis,"

Dr J Herman

PERUVIAN CHAPTER

At the Third Annual Meeting of the Peruvian Chapter of the College, held at the Central Dispensario, Lima, Peru on December 26, 27 and 29, 1947, the following officers were elected for the ensuing year

Dr Ramon Vargas-Machuca, President

Dr Juan Escudero Villar, Vice-President

Dr Leopoldo Molinari, Secretary

Dr Luis E Hubner, Treasurer

Dr Angel L Morales, Librarian

(The program was published in the January-February, 1948 issue of the journal)

SOUTH BRAZILIAN CHAPTER

The South Brazilian Chapter of the College was inaugurated at Sao Paulo on September 28 1947 The organizational meeting of the chapter was held at the time of a local meeting of the Brazilian Tuberculosis

Society Dr Eduardo Etzel, Governor of the College for the South Brazilian States, has reported that the following officers for the chapter were elected

Dr Clovis Correa, President
 Dr Newton Toledo Ferraz and
 Dr Mozart Tavares de Lima, Secretaries
 Dr Bindo Guida Filho, Treasurer

TEXAS CHAPTER

The annual meeting of the Texas Chapter of the College will be held at the Rice Hotel, Houston, on April 26, in connection with the annual meeting of the State Medical Association of Texas, April 26-29 The following program will be presented

MORNING SESSION

Frank H Carman, M.D , F C C P , Dallas, Texas,
 President, Texas Chapter, presiding

"Boeck's Sarcoid,"

J M Donaldson Jr , M D , F C C P , San Antonio, Texas

Discussion opened by

Wayne A Riser, M.D , Wichita Falls, Texas

"Pneumonitis,"

Henry M Winans, M.D , Dallas, Texas

Discussion opened by

R G McCorkle, M.D , F C C P , San Antonio, Texas, and

W D Anderson, M.D , F C C P , San Angelo, Texas

"The Clinical Use of Streptomycin in Tuberculosis,"

Rodger J B Hibbard, M.D , Chief of Tuberculosis, Veterans Facility,
 Legion, Texas

Discussion opened by

David McCullough, M D , F C C P , Kerrville, Texas

"The Problem of Tuberculosis in Texas is the Doctor's Problem,"

Charles M Hendricks, M.D , F C C P , Chairman, Committee on
 Tuberculosis, State Medical Association, El Paso, Texas

Discussion opened by

Howard E Smith, M D , F C C P , Austin, Texas

RECESS TO 2 30 P M

Nominating Committee will convene during recess

AFTERNOON SESSION

H Frank Carman, M D , F C C P , Dallas, Texas,
 President, Texas Chapter, presiding

"A Simplified Method for X-Ray Projection with Demonstration,"

Robert B Morrison, M.D , F C C P , Austin, Texas

Discussion opened by

Walter C Brown, M D , Corpus Christi, Texas, and

Tom R Jones, M.D , F C C P , Houston, Texas

"Dusts of Clinical Significance,"

T M Frank, M.D , Medical Director,
 Pan American Refining Corporation, Texas City, Texas

Discussion opened by

Carl A Nau, M D , Galveston, Texas, and

W W Coulter Jr , M.D , F C C P , McAllen, Texas

"Chronic Atelectasis and Pneumonitis of the Middle Lobe,"

Donald L Paulson, M.D , Dallas, Texas

Discussion opened by
 Howard T Barkley, M.D, Houston, Texas,
 John S Chapman, M.D, F C C P, Dallas, Texas, and
 Henry R Hoskins, M.D, F C C P, San Antonio, Texas

Business Session and Election of Officers

EVENING SESSION

6 00 p m —BANQUET

H Frank Carman, M.D, F C C P, Dallas, Texas, President Texas Chapter, American College of Chest Physicians, presiding

Remarks Activities and Accomplishments of Committee on Tuberculosis of State Medical Association of Texas,
 Charles M Hendricks M.D, F C C P El Paso, Texas

Introduction of Jay Arthur Myers, M.D, F C C P, Past President, American College of Chest Physicians, Minneapolis, Minnesota

8 00 p m —TAYLOR SCHOOL AUDITORIUM, LOUISIANA AND BELL STREETS,

H Frank Carman, M.D, F C C P Dallas, Texas, President, Texas Chapter American College of Chest Physicians, presiding

Guest Speaker Jay Arthur Myers M.D, F C C P, Past President, American College of Chest Physicians Minneapolis, Minnesota
 "Controlling Tuberculosis in a State "

Sponsors

State Organization

Texas Chapter, American College of Chest Physicians

Local Organizations

Medical Staff Houston Tuberculosis Hospital,

Houston Anti-Tuberculosis League

Houston Health Department,

Harris County Dental and Medical Auxiliary,

Health Council of the Houston-Harris County Community Council

Program Committee

Charles J Koerth, M.D, Kerrville, Chairman

Michael A Cunningham, M.D, Beaumont

Cuthbert B Young, M.D, Tyler

Arrangements Committee, Houston Meeting

J Emerson Dailey, M.D, Houston

Charles K Bruhl M.D, Houston

Walter J Stork, M.D, Houston

WISCONSIN CHAPTER

The Milwaukee Metropolitan Section of the Wisconsin Chapter of the College met Friday, January 30, at the Medford Hotel Dr Emil Rothstein presented "Basal Tuberculosis The stimulating paper was followed by an interesting round table discussion

A February meeting of the Milwaukee Metropolitan Section of the chapter was held at the Medford Hotel on Friday the 27th Drs David D Feld and Valentine O'Malley presented a comprehensive study of 'Pulmonary Carcinoma' An interesting round table discussion followed

News Notes

Salvador Diaz, M D , F C C P , Secretary of the Chilean Chapter of the College, reports that the Medical Staff at the Hospital Sanatorio "El Peral," Santiago, Chile, will hold a meeting in May 1948 to review the work of the past ten years at the hospital, especially with regard to the follow-up of patients

A meeting of the "Primeras Jornadas Fisiologicas del Ecuador" was held in Guayaquil, Ecuador, November 24-29, 1947 Drs Juan Tanca Marengo, Jorge A Higgins, and Ernesto Briones, members of the College, are officials of the society

Raymond C McKay, M D , F C C P , Youngstown, Ohio, chief of the tuberculosis division of Cleveland City Hospital, spoke on "The Present Status of B C G Vaccine" at a recent meeting of the medical staff of the Mahoning Tuberculosis Sanatorium

The new medical director of the Mahoning Tuberculosis Sanatorium, Youngstown, Ohio, is William Newcomer, M D , F C C P , formerly assistant medical director of the Moore Veterans Hospital at Swannanoa, North Carolina

George G Ornstein, M D , F C C P , New York City, delivered a talk on "Clinical Experience in the Use of Streptomycin" at a dinner meeting of the Arizona Chapter of the College held at the State Welfare Sanatorium, Tempe, Arizona, on January 24 On January 26, he addressed the staff of the Good Samaritan Hospital in Phoenix The topic of his talk was "Primary Carcinoma of the Lung"

Juan R Herradora, M D , F C C P , Secretary of the Council on Pan American Affairs of the College, Jersey City, New Jersey, returned recently from a visit to Puerto Rico, where he was very hospitably received by members of the College Jaime F Pou, M D , F C C P , President of the Puerto Rico Chapter of the College, gave a cocktail party in honor of Dr and Mrs Herradora at the Condado Hotel Many members of the College were present, including Drs Juan Arruga, Ramon T Colon, J Rodriguez Pastor, Angel Rodriguez Olleros, David Rodriguez, Luis A Passelagua, Antonio Acosta Velarde, David Garcia, Fernando Buxeda, E Martinez Rivera, August Tortorelli, J Porrieta Doric and J Moscoso Cordero

Dr and Mrs Herradora were luncheon guests of Dr Martinez Rivera, and they were entertained at a dinner in the home of Dr Acosta Velarde

Dr Eduardo Etzel, Sao Paulo, Brazil, Governor of the College for the South Brazilian States, will leave Sao Paulo on March 31 for a six weeks stay with Dr Gustav Maurer at Davos, Switzerland, on a fellowship from the Fundacao Virginia Matarazzo of Sao Paulo Dr Maurer is Regent of the College for Europe Dr Etzel is planning to visit Dr Clarence Crafood in Stockholm, Sweden, and Dr Karl Semb, Governor of the College for Norway, at Oslo, following his stay in Switzerland

During a recent lecture tour in Toronto, Paul H Holinger, M.D, F C C P, Chicago, Illinois, was honored at a luncheon given at the University of Toronto Faculty Union William E Ogden, M.D, F C C P, Toronto, Regent of the College, arranged the luncheon which was attended by many of the College members in that area

Burgess Gordon, M.D, F C C P, Philadelphia, Pennsylvania, will leave the United States on March 20 for a tour of the United States Hospitals in Germany as consultant for the Army Dr Gordon will return home on or about April 20th

Hector Orrego Puelma, M.D, F C C P, Santiago, Chile, Regent of the College for Chile, left for Europe early in February He had been invited to give some lectures in London and following his stay in England, Dr Orrego plans to visit France, Italy and Switzerland returning to Chile the first part of May

Jacob J Mendelsohn, M.D, F C C P, Chicago, Illinois, is at the present time visiting in California On February 26, Dr Mendelsohn visited Dr J Segal, Medical Director of the Los Angeles Sanatorium, in Duarte and participated in their staff conference Dr Mendelsohn was enthusiastic about the new unit at the Sanatorium which is in the process of completion, comprising a central medical building for all professional services, flanked on either side by three wings of hospital construction, with a total of 204 beds The sanatorium staff enjoyed Dr Mendelsohn's visit and appreciated his comments during the conference

John M Preston, M.D F C C P, Columbia, South Carolina, has been appointed director of the state board of health, division of tuberculosis control, succeeding Dr Franklin L Gelger, who has resigned

R Y Keers, M.D, Aberdeenshire, Scotland, a member of the College, has published a paper entitled "Observations on Rationing in Tuberculosis" in the *British Medical Journal*, issue of February 7, 1948 Dr Keers is Medical Director of the Red Cross Sanatoria of Scotland

The American College of Allergists will hold its annual meeting this year at the Hotel Pennsylvania, New York City, March 12-14 Fred W Wittich, M.D, F C C P, 423 LaSalle Medical Building, Minneapolis 2, Minnesota, is Secretary of the College

Pablo Purriel, M.D, F C C P, Montevideo, Uruguay, has been appointed Professor of "Clinica Semiologica" by the Faculty of Medicine at the University of Uruguay

Samuel B English, M.D, F C C P, superintendent and medical director of the state sanatorium at Glen Gardner, New Jersey, retired November 1 1947 Joseph A Smith, M.D, F C C P, assistant medical director, succeeds Dr English

Lewis S Jordan, M.D, F C C P, Granite Falls, Minnesota, presented a paper on "The Diagnosis of Tuberculosis in Rural Areas" at the annual meeting of the Missouri State Medical Association, St Louis, on March 15

POSTGRADUATE COURSE IN DISEASES OF THE CHEST

The First Annual Postgraduate Course in Diseases of the Chest to be held in Philadelphia, Pennsylvania, under the sponsorship of the American College of Chest Physicians, Pennsylvania Chapter, and the Laennec Society of Philadelphia, will take place at the Warwick Hotel during the week of March 15th. The instructors who will participate in the course and the titles of their lectures are as follows:

Dr Hobart A Reimann,
"Acute Respiratory Diseases "

Dr Leon H Collins Jr.,
"Mycotic Infections of the Bronchi and Lungs "

Dr Frank W Konzelman,
"Pathology of Chronic Broncho-Pulmonary Diseases "

Dr Chevallier L Jackson,
"Pulmonary Segments in Relation to Broncho-Pulmonary Disease "

Dr Peter A Herbut,
"Laboratory Methods in Diagnosis of Chest Disease "

Dr W Edward Chamberlain,
"Radiological Diagnosis of Acute and Chronic Pulmonary Diseases,"

Dr Hurley L Motley,
"Cardio-Respiratory Physiology "

Dr Charles M Norris,
"Bronchspirometry, Apparatus and Technique "

Dr Hugo Roesler,
"Cardiac Factors in Chronic Pulmonary Disease "

Dr Esmond R Long,
"Epidemiology and Control of Tuberculosis "

Dr Edward M Kent,
"Bronchiectasis "

Dr John H Gibbon Jr.,
"Surgical Treatment of Bronchogenic Carcinoma "

Dr John B Flick,
"Mediastinal Tumors "

Dr Robert D Dripps,
"Anesthesiology in Relation to Thoracic Surgery with Special Reference to Pulmonary Complications "

Dr Richard A Kern,
"Allergic States in Bronchial and Pulmonary Conditions "

Dr Julian Johnson,
"Cardiac Surgery "

Dr Louis H Clerf,
"Bronchoscopy in Diagnosis and Treatment of Chronic Diseases of the Chest "

Dr Joseph B Vanderveer,
"Pulmonary Embolism "

Dr Alvan L Barach,
"Aerosol Therapy in Sinus and Broncho-Pulmonary Infections "
"Total Lung Rest in Pulmonary Tuberculosis as Provided by the Immobilizing Lung Chamber "

Dr Joseph Stokes,
"Tuberculosis in Children "

Dr David A Cooper,
"Diagnosis of Pulmonary Tuberculosis and Evaluation of Activity "

- Dr C Howard Marcy,
 "Pneumoconiosis"
 Dr M D Stayer
 "Sanatorium Administration"
 Dr Ross K Childerhose,
 "Principles of Medical Treatment of Pulmonary Tuberculosis with
 Special Reference to Artificial Pneumothorax and
 Pneumoperitoneum"
 Dr J Winthrop Peabody,
 "The Use and Abuse of Rest in Pulmonary Tuberculosis"
 Drs Gabriel Tucker and Herbert R Hawthorne,
 "Diagnosis and Surgical Treatment of Diseases of the Esophagus"
 Dr John A Kolmer,
 Chemotherapy of Tuberculosis'
 Dr Richard H Overholt
 "Surgery of Pulmonary Tuberculosis"
 Dr E Spurgeon English,
 "Psychosomatic Influence in Chronic Pulmonary Diseases"

The following physicians have been enrolled in the course

Edmund G Beacham Baltimore, Maryland
 B G Begin, Montreal, Canada
 Frank L Bradley, Tahhina, Oklahoma
 John J Brosnan Chicago, Illinois
 H C Burkhead, Long Branch, New Jersey
 M L Connell, Wartrace, Tennessee
 Patrick H Corrigan, Trenton New Jersey
 John Dimun, Trenton, New Jersey
 C H Dorval, Quebec City, Canada
 B J Ellmers, New Milford, New Jersey
 George F Evans, Clarksburg, West Virginia
 Arthur D Fisher Glenn Dale, Maryland
 J V Foster Jr, Harrisburg Pennsylvania
 D R Garrett, Weston, Ontario Canada
 James R Granger, Trenton New Jersey
 Matthew R Hadley, McKeesport Pennsylvania
 Jesse G Hafer, Pottstown, Pennsylvania
 J J Hennessy Hartford, Connecticut
 Howard L Hull, Yakima Washington
 Elmore P Kalbaugh, Glenn Dale Maryland
 Fred Kosanovic, Detroit, Michigan
 Ruben Laurier, Montreal, Quebec
 Julius Lipson, Lockport, New York
 E Leo Lynch, Montreal, Canada
 Simon Marcus, Sherbrooke, P Q, Canada
 Phillip M McNeill, Oklahoma City, Oklahoma
 Edgar R Miller, Wilmington, Delaware
 D D Monroe, Alton, Illinois
 Clarence B Moore Harrisburg, Pennsylvania
 A H Nejat, Woodhaven New York
 G Leonard Oxley, Harrisburg, Pennsylvania
 W B Patterson Huntingdon, Pennsylvania
 H R Patton, Damascus, Pennsylvania
 Thomas H Phalen Binghamton, New York
 H E Peart, Hamilton, Ontario, Canada
 Jacob J Pfeifer Brooklyn, New York
 H E Perez Valhalla New York
 Arthur Powers Ottawa Canada
 William H Rodgers, Philadelphia, Pennsylvania
 Nil Madhab Sinha Calcutta, India
 John R Spannuth, Reading Pennsylvania
 Bernard G Slipakoff, Philadelphia, Pennsylvania
 Alexander Victor Butler Pennsylvania
 Walter E Vest, Huntington, West Virginia
 Joseph J Witt, Utica, New York

Lawrence A Wilson, Absecon, New Jersey
Francis J Welch, Portland, Maine

Medical Officers, U S Army

Lt Col Frank L Bauer, Washington, D C
Col Roosevelt Cafarelli, Phoenixville, Pennsylvania
Lt Col Henry A Kind, Fort Dix, New Jersey
Captain Richard E Mardis, Denver, Colorado
Lt Col Charles K Morris, Mitchel Field, New York

Medical Officers, U. S Navy

Lt Comdr Bruce L Canaga Jr , Philadelphia, Pennsylvania
Lt (jg) Lowell E Golter Jr , Philadelphia, Pennsylvania
Lt James L Mulcahy Jr , Philadelphia, Pennsylvania
Captain Walter H Schwartz, Philadelphia, Pennsylvania

U S Veterans Administration

Felix A Hughes Jr , Memphis, Tennessee
Joseph N Miller, Fort Howard, Maryland
Harry Nushan, Kecoughtan, Virginia
Sam Poller, Castle Point, New York
P E Schools, Martinsburg, West Virginia
A Wolbarsht, Lake City, Florida

NEW FELLOWS

The following candidates successfully passed the oral and written examinations for Fellowship, which were held in November 1947 by the Board of Examiners, and they are entitled to receive their Fellowship Certificates at the next Convocation of the College

Reuben M Anderson, M D , Hackensack, New Jersey
Mary C Block, M D , Santa Ana, California
Walter C Brown, M.D , Corpus Christi, Texas
Joseph J Burrascano, M.D , New York, New York
William S Burton, M D , Richmond, Virginia
Jessie A Lockhart, M D , Houston, Texas
David Meyers, M.D , New York, New York
Robert B Morrison, M.D , Austin, Texas
Luther Byron Newman, M D , Legion, Texas
John L Pool, M.D , New York, New York
M J Rajanna, M D , Oak Terrace, Minnesota
James A Rogers, M.D , Paterson, New Jersey
Selig B Weinstein, M D , Oakland, California

ANNUAL MEETING

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

The 29th Annual Meeting of the American Broncho-Esophagological Association will be held in Atlantic City at the Chalfonte-Haddon Hall on the afternoons of April 7 and 8, 1948 A resume of the program is as follows

"Bronchial Adenomas,"

Louis H Clerf, M D , F C C P , Philadelphia, Pa

"Fibrocystic Disease of the Pancreas, and Its Relation to Pulmonary Suppuration,"

Joseph P Atkins, M.D , F C C P , Philadelphia, Pa

"Bronchoscopic Examination in the Newborn,"

Clyde Heatly, M.D , Rochester, N Y

"Tracheal and Bronchial Obstruction due to Cardiovascular Anomalies,"

Paul H. Hollinger, M.D., F.C.C.P., Chicago, Illinois

"Bronchospirography,"

Charles Norris, M.D., F.C.C.P., Philadelphia, Pa.

"Hiatal Hernia of the Esophagus,"

F. Johnson Putney, M.D., Philadelphia, Pa.

"Syphilitic Tumor of the Bronchus,"

Archibald R. Judd, M.D., F.C.C.P., Hamburg, Pa.

"The Present Status of Broncho-Esophagology in Latin America,"

Chevalier L. Jackson, M.D., F.C.C.P., Philadelphia, Pa.

"Reconstruction Surgery of the Trachea,"

William P. Longmeier Jr., M.D., Baltimore, Md.

"Streptomycin Therapy in Tracheal and Bronchial Tuberculosis,"

John J. O'Keefe, M.D., Philadelphia, Pa.

"Rhinoscleroma of the Bronchus,"

Ricardo Tapia, M.D., F.C.C.P., Mexico City, Mexico

"Allergic Manifestations of Pulmonary Disease,"

Francis W. Davison, M.D., Danville, Pa.

"Hemoptysis due to Chronic Mediastinal Venous Obstruction,"

Stanton A. Friedberg, M.D., Chicago, Illinois

"Granuloma of the Larynx due to Intratracheal Anesthesia,"

Frederick T. Hill, M.D., Waterville, Maine

Members of the profession are cordially invited to attend the meeting

JOURNAL "TUBERCLE" ADOPTED BY BRITISH TUBERCULOSIS ASSOCIATION

Members of the College everywhere will be interested to learn that the Tuberculosis Association in London, England, has made known the fact that its members have unanimously agreed to adopt the medical journal "TUBERCLE" as the official organ of the Association. Inquiries regarding this publication should be addressed to the Association at Manson House, 26 Portland Place, London, W 1, England.

DR SCHEELE TO SUCCEED DR PARRAN AS SURGEON GENERAL

The White House has announced the nomination of Dr. Leonard A. Scheele as Surgeon General of the U. S. Public Health Service, to succeed Dr. Thomas Parran when the latter's term expires April 6, 1948.

ILLINOIS CHAPTER

The Illinois Chapter of the College will hold its annual meeting in Chicago on May 10, at the time of the annual meeting of the state medical society. There will be a business meeting followed by a dinner to which a guest speaker has been invited. The following members of the College will present papers in the scientific session of the Illinois State Medical Society meeting:

"Detection of Various Chest Lesions by Mass X-Ray Surveys,"
Dan W. Morse, M.D., F.C.C.P., Peoria, Illinois

"Recent Techniques in the Management of Bronchial Infections,"
Edwin R. Levine, M.D., F.C.C.P., Chicago, Illinois

"The Present Status of Streptomycin,"
Karl H. Pfuetze, M.D., F.C.C.P., Cannon Falls, Minnesota

ROCKY MOUNTAIN CHAPTER

The Rocky Mountain Chapter of the College and the Denver Sanatorium Association will hold a mid-winter meeting at the Lutheran Sanatorium, Wheat Ridge, Colorado, on Tuesday, March 23 The program for this combined meeting will be as follows

Report of Cases

"Pulmonary Resection Following Thoracoplasty Complicated by Tuberculous Empyema,"

"Tuberculous Bronchitis Complicated by Atelectasis, Treated with Streptomycin,"

John A Cremer, M D , F C C P , Denver, Colorado

"Observations on Concurrent Disease and Tuberculosis,"

M Stein, M D , Denver, Colorado

"Surgical Treatment of Chronic Lung Abscess,"

Captain A J Neerken, MC, U S A , Denver, Colorado

"Report on Streptomycin Research at Fitzsimons General Hospital,"

Captain Jack Durrance, MC, U S A , Denver, Colorado

"Surgical Treatment of Tuberculous Empyema,"

Fred R Harper, M.D , Denver, Colorado

"Bronchial Asthma,"

Frank T Joyce, M D , Denver, Colorado

"Sympathectomy in Asthmatic Bronchitis,"

John B Grow, M D , F C C.P , Denver, Colorado

"Psychiatric Problems in the Chronically Ill,"

Lewis Barbato, M.D , Denver, Colorado

"Pulmonary Function Studies as a Practical Aid to Chest Surgery,"

Sidney H Dressler, M.D , Denver, Colorado

"Fungus Infection in the Rocky Mountain Area A Roentgenographic and Skin Testing Survey,"

Frank Cline Jr , M D , Fort Logan, Colorado

A complimentary luncheon will be given at which the guest speaker, Dr F Jensen, Director of Graduate and Postgraduate Medical Education, Colorado University School of Medicine, will talk on "Current Concepts of Graduate Education as Applied to Pulmonary Diseases"

THE NATIONAL BLOOD PROGRAM

The procurement of sufficient whole blood to meet the ever increasing demand for blood is one of the major problems confronting the medical profession today Doctors and hospitals are apprehensive—even desperate Neither nature nor science offers a substitute for human blood It cannot be compounded or manufactured as are medical supplies and drugs Nor can blood be purchased commercially and distributed in the amounts needed without costs that are beyond the resources of the vast majority of the people The operation of blood banks by the individual hospitals is limited in application and cannot be expected to meet the national needs It is only by the procurement and distribution of blood on a large scale that costs can be lowered and the quantities necessary be provided

The National Blood Program of the American Red Cross is now being organized to provide sufficient blood and blood derivatives, without charge, to the entire nation to help save lives and meet the ever increasing demands for whole blood Prior to its adoption the program was discussed with and approved in principle by the American Medical

Association, the American Hospital Association and the Catholic Hospital Association

As a beginning, there will be one National Blood Program center located in each of the 5 Red Cross areas and one at national headquarters. An additional 20 to 25 centers, located at key points throughout the country, are scheduled for opening in 1948. Other centers will be established as rapidly as possible.

Since people in rural districts require blood as well as those in cities the program must be sufficiently flexible to meet widely varying conditions and needs in large and small communities throughout the country. It is the ultimate goal to collect blood from volunteers from every community everywhere and to give every healthy person an opportunity to make a contribution at least once a year.

The entire program will be financed by the American Red Cross.

This tremendous project which will require approximately 5 years to put into complete operation, merits and needs the utmost support and active cooperation of every physician in the nation.

Dr. Harold B. Kenton, Blood Bank,
New England Deaconess Hospital, Boston, Massachusetts

HEART DISEASE AND CANCER CAUSE MOST DEATHS IN THE U S A

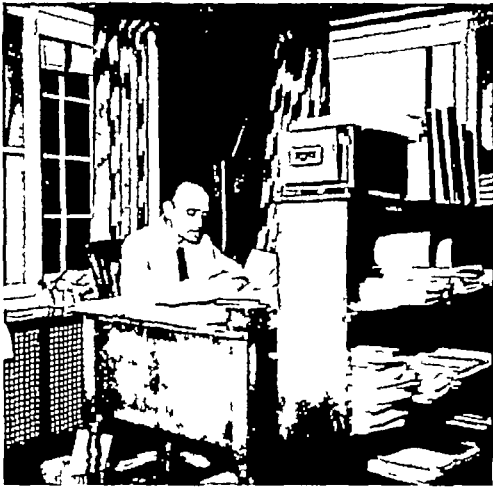
The experience of the Mutual Life Insurance Company of New York, according to a study made public of the causes of death among its 1,000,000 policyholders in 1947 is as follows:

	All Ages	Under 40	40-59	60 & Over
Diseases of Heart and Circulatory System	57.3%	14.6%	53.8%	61.9%
Cancer	14.6	11.4	15.8	14.4
Accidents	5.0	35.7	6.3	2.1
Disease of the Kidneys	3.6	2.9	2.7	4.1
Influenza and Pneumonia	3.6	3.1	2.8	4.0
Suicide	1.6	6.2	3.0	7
Tuberculosis	1.0	3.7	1.5	6
All other causes	13.3	22.4	14.1	12.2

Obituaries

MAX PINNER

1891 - 1948



Max Pinner was born in Berlin at a time (November 28, 1891), when one scientific achievement after the other was being announced, many of which were made in or near his native land. Only nine years before, Koch had announced the discovery of the tubercle bacillus, and one year before had prepared tuberculin. In 1890 it was reported that there were two distinct types of tubercle bacilli, namely, the human and the avian. In 1896 Theobald Smith, of Harvard University, proclaimed that he had isolated a third, the bovine

type of tubercle bacillus Forlanini, of Italy, had introduced the modern practice of artificial pneumothorax in 1888. Roentgen, of Germany, presented the x-ray in 1896, and Kilian of the United States, invented the bronchoscope in 1898. Their world renowned discoveries and many others made within less than ten years before and after the birth of Max Pinner must have been the subjects of frequent conversation and discussion in many households and wherever people were assembled for any purpose. As Max became conscious of the world about him, he must frequently have listened to recitations concerning these scientific achievements and later participated in the discussions himself. Thus, he early became imbued with scientific information and particularly with that pertaining to tuberculosis. Most likely all of this played an important part in his decision to study medicine. His medical studies were interrupted by World War I, when he served with the German army medical corps from 1915 to 1919. However, in 1920 he received the degree of Doctor of Medicine from Tübingen University. He became voluntary assistant at the Rudolph Eppendorfer Krankenhaus in Hamburg. He had a keen interest in tuberculosis so he knew of the fine work of E. L. Trudeau in establishing the Adirondack cottage sanitarium, that of Theobald Smith, who isolated the bovine type of tubercle bacillus, that of M. P. Ravenel who proved that the bovine type of tubercle bacillus is pathogenic for man. He knew about the fine accomplishments of the National Tuberculosis Association and the American Sanatorium Association and their component societies. He knew of the fine sanatorium building program in America. Probably the great opportunities he saw for accomplishments in tuberculosis control work in the United States influenced him to come here. In any event, he arrived in 1921. He began work in the Chicago Municipal Tuberculosis Sanitarium, where he received excellent instruction and help from Dr. Henry Sweany and other members of the medical staff. He then went to Detroit and worked in the Maybury Sanatorium and the Herman Klefer Hospital. Here he

received fine instruction and support from the various physicians in tuberculosis and, particularly, Dr Bruce Douglas Dr Pinner so won the admiration of Dr Allen K Krause of the Johns Hopkins School of Medicine that when he accepted the directorship of the Desert Sanatorium at Tucson, Arizona in 1929, he invited Dr Pinner to join the staff. Here they worked together in the development of the institution. When Dr Krause resigned from the Desert Sanatorium Dr Pinner accepted a position as diagnostic pathologist for the tuberculosis hospitals of the New York State Department of Health in 1935. Three years later he became head of the division of pulmonary diseases of the Montefiore Hospital in New York City and was also made clinical professor of medicine at Columbia University.

In his early association with Dr Allen Krause, Dr Pinner aided considerably with the *American Review of Tuberculosis*. As Dr Krause's health began to fail this work increased, and he was made associate editor in 1937 and advanced to the editorship after Dr Krause's death in 1941. When the *American Review of Tuberculosis* was founded by the National Tuberculosis Association in 1917, Dr Edwin R Baldwin of Saranac Lake, New York was chosen as editor-in-chief. However, in 1922 Dr Krause of Baltimore was induced to take the editorship, but Dr Baldwin remained on the Editorial Board until his death on May 6, 1947. Under the editorship of Dr Baldwin and Dr Krause the *American Review of Tuberculosis* became one of the finest publications of its kind in the entire world. During the ten years that he was associate editor and editor, Max Pinner maintained the high standards established by his predecessors.

There has been a friendly relationship between the *American Review of Tuberculosis* and *Diseases of the Chest*. Indeed, on more than one occasion the editors of these journals discussed their mutual problems and how they could best be solved. Each journal received definitely more manuscripts than it could possibly publish. Therefore, the one recognized the need for the other. As a Fellow of the American College of Chest Physicians, Dr Pinner took pride in the official organ *Diseases of the Chest*. As a former member of the Editorial Board of the *American Review of Tuberculosis* and an active member of both the National Tuberculosis Association and the American Trudeau Society, the editor of *Diseases of the Chest* takes a great deal of pride in the fine attainments of the *American Review* and the organizations it represents.

In addition to his usual duties Max Pinner was always ready to participate in other helpful projects. For example, in 1932 he and Mrs Pinner translated from German Koch's original paper announcing the discovery of the tubercle bacillus which was read before the Physiological Society in Berlin on March 24, 1882 and was published the same year. This translation was a splendid contribution to English-speaking physicians everywhere.

Only last year, in the preparation of a volume entitled "Classics on Tuberculosis," by Dr Allen K Krause, Dr Pinner gave me a great deal of help in selecting the writings of Krause which seemed most suitable for publication in such a volume. Moreover, he cheerfully gave permission to reprint some of Krause's articles which had originally appeared in the *American Review*, as he had so often done before and since when requests were made to borrow illustrations and other materials which had been published in the *Review*.

Dr Pinner wrote many fine articles which were published in various

medical and scientific journals. These contained the results of his investigations which contributed to our knowledge of tuberculosis. His editorial on "Primary Infection" which appeared in the October 1947 issue of the *Review* is a splendid and thought-provoking discussion of the subject. His book entitled *Tuberculosis in the Adult*, presents the various phases of the subject exactly as he saw them. The introduction describes how he attempted to write a different kind of book on tuberculosis than had previously been published. He had a magnificent literary style which, together with his thoughts on the subjects presented, made the book exceedingly worthwhile and popular. Although he was revising it at the time of his death, it can be read as it now stands with great profit for many years. His distinguished contributions to the tuberculosis field were recognized everywhere and culminated in the award of the Trudeau Medal of the National Tuberculosis Association in 1946.

Dr. Pinner was a member of all of the medical and scientific associations and societies in the fields of pathology, bacteriology, tuberculosis and closely associated subjects. Throughout his life Dr. Pinner was an ardent worker. He did every job well, whether it be teaching, writing, investigating, or examining patients.

Upon developing a serious heart condition in 1946, Dr. Pinner resigned his New York positions and moved to Berkeley, California. The offices of the *American Review of Tuberculosis* were also transferred to that location. There he continued to edit the *Review* until his death on January 7, 1948. He will be greatly missed, but his immediate survivors, as well as those of future generations, will be benefited by his contributions.

Jay Arthur Myers, M.D., Minneapolis, Minnesota

SAMUEL HUMES WATSON

1877 - 1948

Dr. Samuel Humes Watson, nationally known for his pioneering work in tuberculosis and allergies, died in his home in Tucson, Arizona, on February 5. Dr. Watson was born in Vinton, Iowa, and attended schools in his birthplace and then went to Cornell College at Mt. Vernon, Iowa, later transferring to Rush Medical College in Chicago from which he was graduated in 1899. He began his career as a practicing physician at Blairstown, Iowa, but moved to Tucson in 1911 after his health had failed. He began practicing in Tucson shortly after arriving there and continued active work until June 1947, when he became ill.

Dr. Watson was medical director of the Tucson Arizona Sanatorium from 1912 to 1918, and had been a member of the medical staff at St. Mary's Hospital and Sanatorium, and physician in chief at Barfield's Sanatorium, St. Luke's In-The-Desert, and at Anson's Rest Home, throughout the years. In 1922 Dr. Watson, together with Dr. Meade Clyne and the late Dr. Charles S. Kibler, formed the Tucson Clinic.

In 1928-29 Dr. Watson was president of the Arizona State Medical Association, and had also served as president of the Arizona Anti-Tuberculosis Association and the Pima County Medical Society. He was active in the Southwest Medical Association. Dr. Watson was a Fellow of the American College of Chest Physicians, the American College of Physicians and the American Medical Association.

Howell Randolph, M.D., Governor for Arizona

PHILIPP SCHONWALD

1880 - 1947

Dr Philipp Schonwald, a fine physician, scientist and humanitarian, was born and educated in Vienna His training was not only medical but also cultural He mastered six languages, wrote and directed operettas and was a skillful violinist In 1921 an uncle, who had traveled extensively in the United States, described to him the Pacific Northwest as "God's Own Country" This tale so fascinated him that he decided to move to Seattle where he could enjoy the fields, streams, and mountains while pursuing his medical career as a chest specialist

During 26 years' practice in Seattle, Dr Schonwald served on the staffs of the Riverton, Morningside and Swedish Hospitals and was the author of numerous papers on diseases of the chest He was one of the original investigators on the allergic factor of soil bacteria and an early investigator on allergies traceable to mold spores In November 1943 when life-saving penicillin was denied to civilian populations because of wartime demands of the military Dr Schonwald developed a substitute that won him world fame

Dr Schonwald was a member of the American Medical Association King County and Washington State Medical Societies, and a Fellow of the American College of Chest Physicians American Academy of Allergists, American Trudeau Society and the American College of Physicians

Death came to Dr Schonwald at his home in Seattle on December 27, 1947 His life's accomplishments are an inspiration to all who desire to give so that this may be a better world

John E Nelson M.D , Governor for Washington

FRANK TRUMBO HARPER

1909 - 1947

On July 4, 1947, while taking off at the Burlington Airport in a small cabin plane, Dr Frank Trumbo Harper age 38, was instantly killed The plane piloted by a friend went into a 'power stall' and both occupants met death in the accident

Dr Harper, a native of Kinston N C, was graduated at the Medical College of Virginia in 1934 Having contracted tuberculosis himself, he became especially interested in that disease and spent several years at State Sanatorium under the tutelage of the late Dr P P McCain and at the Jamestown Sanatorium with Dr M D Bonner

Locating in Burlington in 1941, Bo Harper, with his innate ability and thorough training in internal medicine and tuberculosis, with his versatile leadership affable disposition and hard work, soon built up a large practice Being a member of several Medical Associations, he contributed numerous original papers on the programs of these organizations He was active in two civic clubs Chamber of Commerce, Boy Scouts Tuberculosis Association, Cancer Control Committee and for several years was director of the Alamance County Tuberculosis Sanatorium Largely through Dr Harper's efforts a portable x-ray unit for County-wide chest examinations was purchased just before his untimely death Over \$25,000 00 has recently been donated to the Bo Harper Memorial Fund—to further the work in tuberculosis for which he had given so freely of his time and energy

Burlington and Alamance County and the State of North Carolina will continue to miss Bo Harper—whose tragic end came in the prime of life when men of his type are so greatly needed. His widow and three daughters reside in Burlington, N C, and his mother, brother and sister in Kinston, N C

M D Bonner, M.D., Governor for North Carolina

MANUSCRIPT SERVICE ANNOUNCED

The establishment of a manuscript service has been announced, which is an organization devoted to ethical editorial service in the field of medicine and allied sciences. The name of the firm is Manuscript Service, Inc., and the address is 6432 Cass Avenue, Detroit, Michigan.

Manuscript Service, Inc. has been organized to facilitate publication of clinical and experimental research, case records and historical reviews by providing ethical editorial assistance for authors who do not have adequate library facilities available, those who do not have sufficient contact with the publishing field, and those whose time is limited. The service is directed by an editor with many years of experience in the preparation and publication of papers and books concerned with the clinical diagnosis and therapy, surgery, nutrition, psychiatry, mental hygiene, dentistry, anthropometry, roentgenology, physiology and biochemistry.

SUMMARY OF TUBERCULOSIS SERVICE IN THE UNITED STATES

	Hospitals	Beds	Admissions
Federal	23	8,536	16,778
State	77	26,862	22,313
County	180	23,577	22,417
City	25	10,192	19,357
City-County	15	2,242	2,067
Church	21	2,524	4,173
Nonprofit	79	7,635	9,640
Individual and Partnership	20	803	1,782
Corporations	10	816	1,214
TOTAL	450	83,187	99,741

Tuberculosis sanatoriums, which can accommodate 83,187 patients, showed an increase of 4,413 beds in 1946. These figures, however, do not include the tuberculosis facilities that are regularly available in many of the general and psychiatric hospitals as well as other institutions. Eighty five per cent of the beds in tuberculosis hospitals will be found in institutions operating under government control. In summary, it may be noted that the general, psychiatric and tuberculosis hospitals as a group have 95.3 per cent of all registered hospital beds.

*Abstracted from "Hospital Service in the United States," 1947, 26th Presentation of Hospital Statistics by the Council on Medical Education and Hospitals of the American Medical Association.

DISEASES *of the* CHEST

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The Treatment of Patent Ductus Arteriosus*

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Portland, Oregon

The surgical treatment of patent ductus arteriosus has been employed more and more widely since Gross reported the first successful case of ligation in 1939. It now appears that we may improve the health and prolong the lives of most children and young adults in whom patency of the ductus arteriosus persists. An increasingly large volume of literature, both in this country and abroad, attests to the fact that this opinion is held by cardiologists and thoracic surgeons alike.

When asked to present a paper on the treatment of patent ductus arteriosus before this meeting of the College, it was my feeling that the subject had been covered more than adequately in the numerous comprehensive articles that have been published. The diagnostic and operative criteria have been well established by the original contributors in this field. It may be of value, however, to review, as briefly as possible, the important contributions that have been made, and to place on record my own small series of cases and the interesting or unusual situations that I have encountered.

Nature and Causes

Anatomical obliteration of the ductus arteriosus frequently does not occur until several weeks or months following birth. According to Christie,⁷ 64.7 per cent are still open at two weeks, 44.3 per cent at four weeks, and 12 per cent at eight weeks of age. By the eighth month 98 per cent were found to have closed. Patency existing after the first year of life is more likely to be permanent and to

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function as a vascular shunt, though obliteration of a patent duct seems, in rare instances, to have occurred in later years^{10 35}

The exact mechanism which results in physiological closure of the ductus arteriosus is still obscure Kennedy and Clark^{24 25} and Kennedy²⁶ have investigated this problem and a number of hypotheses have been summarized by Mackler and Graham²⁹ and by Wells⁴² Several factors may be involved It seems likely that functional closure of the duct generally occurs as soon as the lungs are ventilated²⁶ According to Schaeffer's studies³⁴ the duct gradually becomes obliterated over a period of several weeks as a result of elastic tissue hypertrophy and proliferation which begins during the latter part of fetal life

In the presence of certain cardiovascular anomalies an associated patent ductus arteriosus serves as an important channel joining the systemic and pulmonary circulatory system By circumventing an obstructed aorta or pulmonary artery, such a duct may permit blood to reach the peripheral vascular bed of either system Congenital cardiovascular defects of this character might include the following

- 1 Aortic obstruction
 - a Aortic atresia or subaortic stenosis
 - b Bicuspid or stenotic aortic valve
 - c Coarctation of the arch of the aorta
- 2 Pulmonary artery obstruction
 - a Pulmonary atresia
 - b Pulmonary stenosis (Tetralogy of Fallot)
- 3 Complete transposition of the great trunks

Under these conditions patency of the ductus arteriosus supports or permits the continuation of life and an attempt surgically to eliminate the flow of blood through the duct is definitely contraindicated In some of these cases it may actually be desirable to establish an additional communication between the two systems by producing an artificial ductus arteriosus according to the methods of Blalock and Taussig³

Autopsy series indicate that in over one-third of cases in which a patent ductus arteriosus persists there are no associated cardiovascular anomalies¹ As obscure as the mechanism of normal physiological closure is the failure of such closure to occur Gross¹⁶ suggests three possible etiologic factors

- 1 The anatomic position and direction of the vessel
- 2 A defect in the wall of the vessel
- 3 A neuromuscular mechanism (vagus deficiency)

Whatever the conditions responsible for persistent patency may be, it has been estimated by Keys and Shapiro,²⁷ that there are approximately 20,000 such cases in the United States

Physiology and Pathology

During fetal life the direction of blood flow through the ductus is from pulmonary artery to aorta (Fig 1) Following ventilation of the lungs and increase in the pulmonary circulation, the pressure relationships are altered and the blood flow through the ductus is reversed (Fig 2) Burwell, et al,^{5,13} have demonstrated that 45 to 77 per cent of all the blood leaving the left ventricle will pass from the aorta through a persistent patent ductus arteriosus into the pulmonary artery To compensate for the loss of blood to the peripheral circulation, the volume output

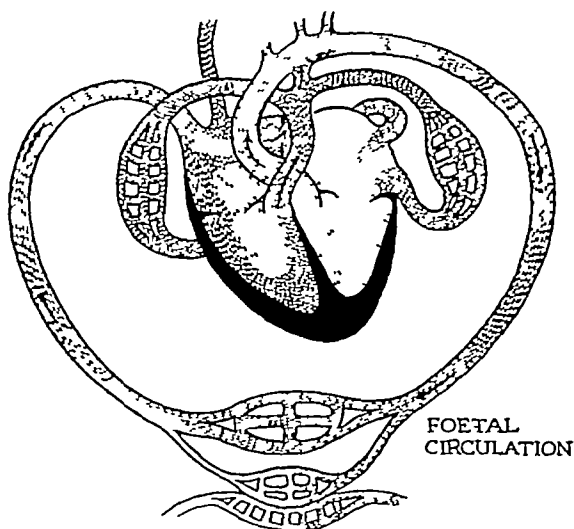


FIGURE 1

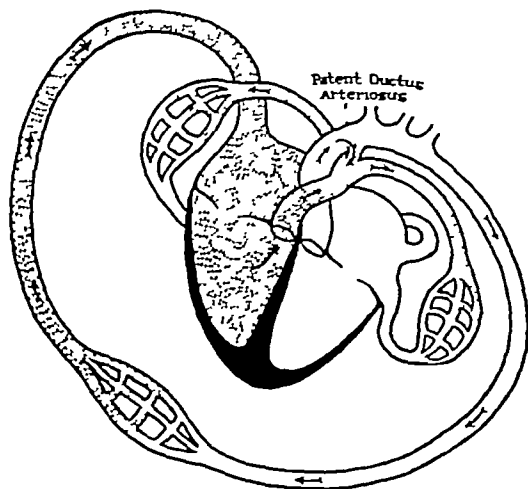


FIGURE 2

of the left ventricle must increase and becomes two to four times as great as the output of the right ventricle. This results in ventricular enlargement and eventually may produce manifestations of left ventricular strain and failure.

The persistently patent ductus arteriosus, then, is an abnormal vascular shunt. While Leeds²⁸ has pointed out certain differences, the cardiac and hemodynamic manifestations are similar to those associated with an arteriovenous fistula or with aortic regurgitation. The forceful flow of blood from the aorta through the duct into the pulmonary artery sets up traumatizing currents and eddies and damages the walls of these vessels producing thickening of the intima, deposition of cholesterol and the formation of atheromatous plaques. Here it is that vegetations of bacterial endarteritis seem likely to occur. Likewise the forceful pressure of blood flowing from the aorta may result in aneurysmal dilatation, or even rupture, of a relatively thin-walled duct.²⁹ Reduction in peripheral circulation is considered to account for the reduced rate of growth and development of some children in whom the ductus remains patent.

In her classical study of 1,000 cases of congenital heart disease,¹ Maude Abbott found ninety-two cases of simple patent ductus arteriosus. The mean age of death in this group was twenty-four years, however twenty deaths occurred before the age of five. Bullock, Jones and Dolley,⁴ eliminating cases that died in infancy, reviewed eighty cases over three years of age and found that 14 per cent had died from their heart lesion at the age of fourteen, 50 per cent at the age of thirty and 71 per cent at the age of forty, only two living into the seventh decade. These and other studies provide ample evidence that a simple patent ductus arteriosus results in a marked reduction in the normal life expectancy.

CAUSES OF DEATH IN CASES OF PATENT DUCTUS ARTERIOSUS

Causes of Death	Abbott	Bullock, Jones and Dolley	Shapiro and Keys
(Cardiovascular)	(92 cases)	(80 cases, 3 yrs old and over)	(60 adults)
Subacute bacterial endarteritis (or endocarditis)	21	42 - 53%	41.7% 6.6% (probable)
Congestive heart failure	24	18 - 23%	28.3%
Sudden death (cardiac?)	16		
Rupture of aneurysm		5 - 6%	6.6%
Heart important factor		4 - 5%	1.7% (suicide)
TOTAL	61 - 66%	69 - 86%	84.9%

The high incidence of premature death, due directly or indirectly to persistence of a patent ductus arteriosus, is illustrated in Chart I, compiled from the publications by Abbott, by Bullock, Jones and Dolley, and by Shapiro and Keys

It is logical to assume that surgical ligation or division of the patent ductus arteriosus, by eliminating the abnormal shunt, would have prevented or postponed most of the fatalities listed

Clinical Findings

While twenty of Maude Abbott's cases died before the age of five years, an attempt to diagnose a patent ductus arteriosus in early childhood is rarely made. There is no sure method for determining the presence of a patent ductus in early childhood. It is only in the third and fourth years that the typical clinical findings are likely to become evident.

The symptoms that may be associated with patent ductus arteriosus include the following:

- 1 Fatigability
- 2 Weakness
- 3 Irritability
- 4 Palpitation on exertion
- 5 Pain or discomfort in the left hemithorax
- 6 Breathlessness
- 7 Syncope
- 8 Sensitivity to cold
- 9 Epistaxis
- 10 Headaches
- 11 Hoarseness

The physical findings include

- 1 Subnormal weight and physical development
- 2 Pallor
- 3 Tachycardia
- 4 *Continuous murmur in the pulmonic area*
- 5 *Palpable thrill*
- 6 *Accentuated or reduplicated pulmonic second sound*
- 7 *Increase in pulse pressure with low diastolic pressure (exercise)*
- 8 *"Pistol shot" sound over the femoral arteries (exercise)*
- 9 Corrigan pulse
- 10 Capillary pulse

The ductus arteriosus remains patent about twice as frequently in females as in males. Cyanosis usually does not occur with an uncomplicated patent ductus arteriosus. If it does, it is a manifestation of reversal of flow through the duct. Increased pressure in the pulmonary circulation, as in coughing, crying and respiratory obstruction, may produce transient cyanosis, or cyanosis may appear terminally when the heart begins to fail (*cyanose*

tardive) Clubbing, polycythemia and other evidences of the cyanotic types of heart disease are absent

Roentgenographically the pulmonary artery appears prominent as seen in the postero-anterior (Fig 3) and right anterior oblique projections The heart may be enlarged Through the fluoroscope one can usually demonstrate increased excursion of the left ventricle, with expansile pulsations of the pulmonary artery and its branches presenting the picture of so-called "hilar-dance"⁹ Studies with diodrast ordinarily are neither necessary nor attempted The ductus itself has not been visualized, but recirculation of diodrast through the ductus, producing prolonged filling of the pulmonary circuit, would be expected and does occur According to Steinberg, Grishman and Sussman,³⁷ a localized dilatation of the descending aorta, just beyond the isthmus, can be visualized by angiography Occasionally angiocardiology is of value in atypical cases in order to rule out associated cardiovascular lesions which would contraindicate surgery

The electrocardiogram is ordinarily normal A normal right axis



FIGURE 3 (Case No 8) FS Illustrating prominent pulmonary artery segment at upper left border of heart, as seen in PA chest film

deviation is sometimes seen, especially in the young, but deviation to the left is also consistent with an uncomplicated patent ductus arteriosus. The electrokymograph²¹ may prove to be of value, particularly in recording pulsations of the pulmonary artery.

Medical Treatment

An uncomplicated case of persistent patent ductus arteriosus requires no medical treatment. While many of these cases are below average in physical development, the majority tolerate normal activity fairly well until complications supervene. Too often anxious parents, apprised of a heart ailment, will overprotect the child. Undue concern and restriction of activities results in psychological damage both to the child and to his siblings.

When congestive heart failure or subacute bacterial endarteritis develop, medical treatment must be instituted promptly, but surgical treatment should be given immediate consideration. Bacterial endarteritis complicating a patent ductus arteriosus has been cured by medical therapy.^{6, 43} Touroff⁴¹ has reported a case which, having recovered from subacute streptococcus viridans endarteritis, superimposed on a patent ductus arteriosus, developed a recurrence of the infection twelve and one-half years later and then recovered once more following surgical treatment. Medical treatment certainly provides no safeguard against eventual recurrence nor against the other complications that are prone to occur.

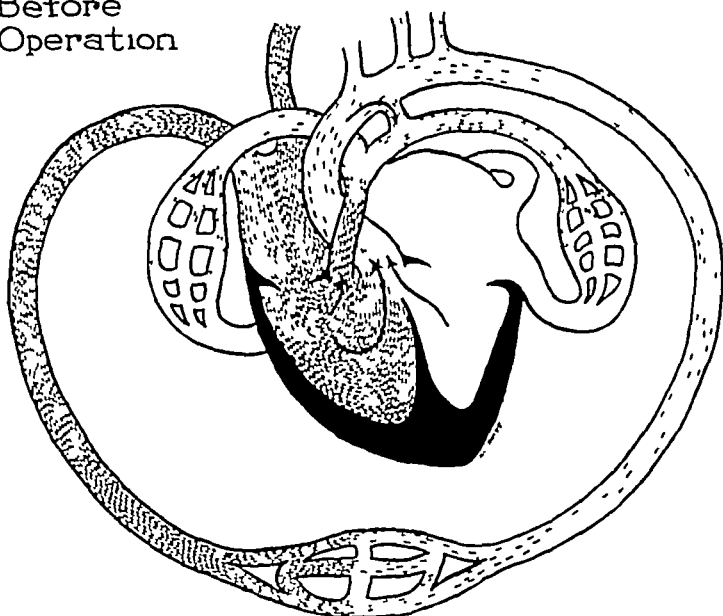
Surgical Treatment

In 1907 Munro³⁰ reported the isolation of a patent ductus arteriosus at necropsy, demonstrating the feasibility of its surgical ligation. At that time the diagnostic criteria were, it seems, not adequately established and not until 1938 was an ante-mortem attempt to obliterate the duct recorded. Complete obliteration of the duct in this case, reported by Graybiel, Ashton, Strieder and Boyer,¹¹ was not accomplished and the patient, who had a superimposed bacterial endarteritis, died on the fourth post-operative day with acute dilatation of the stomach.

The first successful case of surgical ligation of a patent ductus arteriosus was reported by Gross and Hubbard¹² in 1939. The brilliant response of this and succeeding cases to surgical treatment has encouraged ever wider application. It soon became evident that the surgical approach to this condition, either by ligation or division, may offer those who have a persistent patent ductus arteriosus the chance for normal survival.

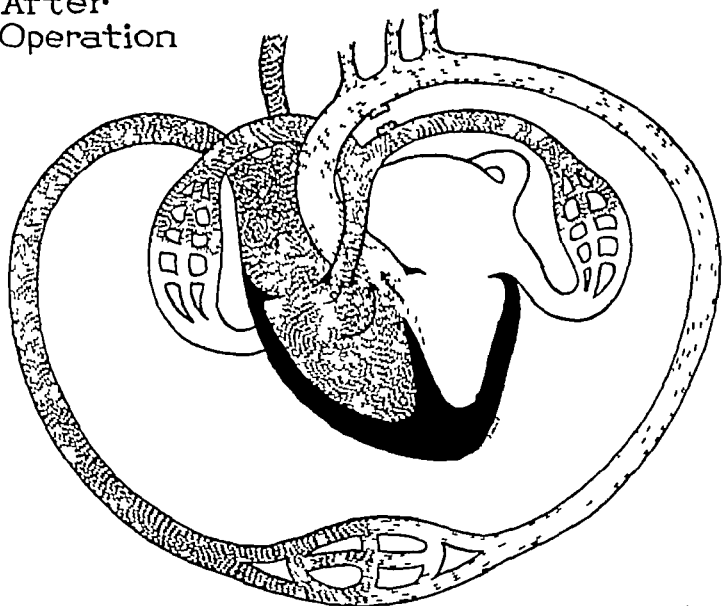
Specific indications for surgery, according to Gross,¹⁶ include the following: 1) Stunting of physical growth; 2) Cardiac embarrassment; 3) Voluntary limitation of physical activity; 4) Evi-

Before
Operation



Effect of Ligation of ductus on coexisting
Tetralogy of Fallot

After
Operation



Effect of Ligation of ductus on coexisting
Tetralogy of Fallot

FIGURE 4 These schematic diagrams illustrate the increased cyanosis that results from ligating or dividing a patent ductus arteriosus in the presence of a coexisting pulmonary artery stenosis. In reverse order they indicate how the cyanosis of Tetralogy of Fallot may be relieved by establishing an artificial ductus arteriosus (Blalock-Taussig operation).

dence of a particularly large shunt Since Touroff^{83 40} demonstrated that the peripheral blood stream may be sterilized by ligation of a patent ductus arteriosus complicated by bacterial pulmonary endarteritis, the presence of such superimposed infection is generally accepted as an urgent indication for surgical intervention

Whether or not surgery is indicated as a purely prophylactic procedure has been open to some debate In skilled hands the surgical mortality has been so low, even during the developmental era of this procedure, that the hazards of surgery seem well justified when there is prospect of adding some twenty or thirty years of life to a child's expectancy The fact that an occasional duct has appeared to obliterate spontaneously even during the later years of life^{10 35} provides some basis for argument against prophylactic surgery This, however, does not alter the fact that the case who lives out his normal life span is the exception in the group as a whole

I would like to emphasize again that the presence of other cardiac anomalies, for which the ductus acts as a compensatory blood channel, provides a definite contraindication to interruption of this vessel I understand that such surgery has been performed and of course with deleterious results (Fig 4) In general it may be stated that persistent cyanosis per se is a contraindication to ligation or division of a patent ductus arteriosus

The technics that have been used are well presented by Gross^{12 17} and have been modified very little by others Inhalation anesthesia through a closed system with an endotracheal tube is preferred The surgical approach is through the third intercostal space anteriorly, or through the periosteal bed of the fourth or fifth resected rib posteriorly as advocated by Harrington²⁰ The diagnosis is confirmed by palpating the duct and the thrill which is transmitted to the pulmonary artery The phrenic and vagus nerves are identified and the mediastinal pleura is incised between them The ductus arteriosus is isolated by blunt dissection avoiding injury to the vagus and recurrent laryngeal nerves and to the extension of pericardium that sometimes approaches the duct from the pulmonary artery Before the duct is permanently interrupted it should be occluded by compression Should cyanosis appear during this maneuver the duct must be left intact since there is probably an associated pulmonary stenosis On occlusion of the duct the palpable thrill will immediately disappear or markedly diminish Some thrill may persist if the pulmonary artery is greatly dilated

Simple ligation of the duct with a single strand of non-absorbable suture material, as formerly practiced, has been found unsuitable because in too many instances the shunt became

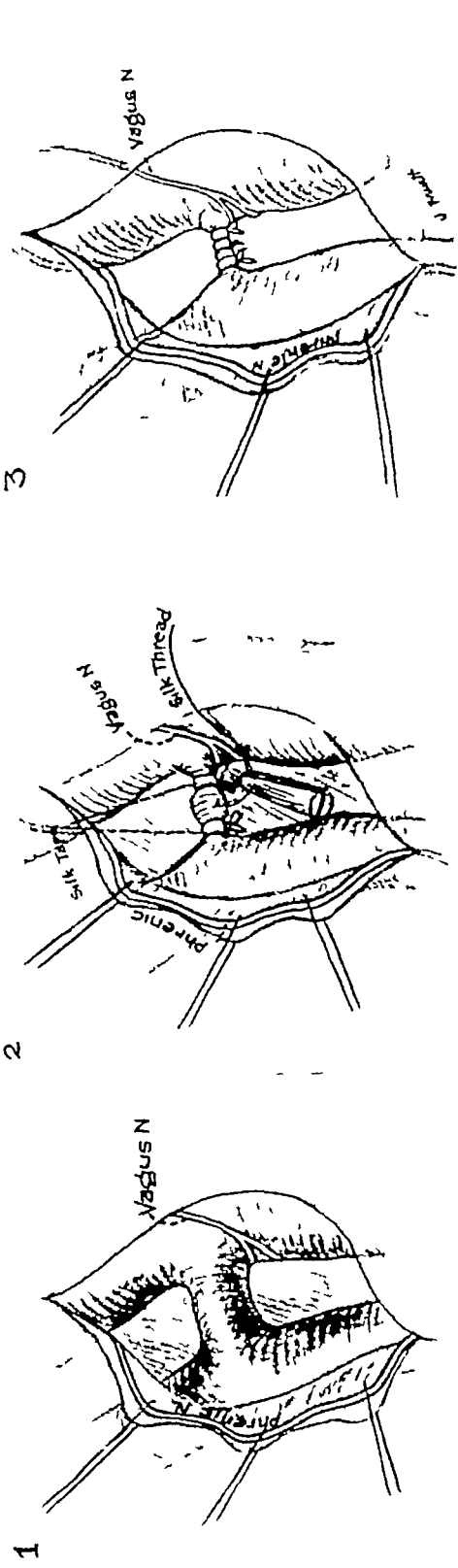


FIGURE 5 (1) Patent ductus arteriosus exposed Flap of mediastinal pleura and phrenic nerve retracted with silk traction sutures (2) Tape ligatures at each end of ductus arteriosus Introduction of transfixion suture (3) Ductus arteriosus obliterated with two tape ligatures and transfixion suture

re-established by recanalization around the ligature. To avoid such operative failures other techniques have been devised: multiple ligatures, wrapping the ligated duct with a type of cellophane which causes a severe sclerosing reaction,¹⁹ obliteration of the entire length of the duct, including, perhaps, portions of the adjoining arterial walls, with tape ligatures, the use of mattress or transfixion sutures in conjunction with the above methods, and finally division of the duct between clamps with suture closure of its divided ends by the technic which Gross¹⁷ has described and used with such spectacular success. An additional technic for dividing the duct has been used by Crafoord⁸ who recommends clamping the aorta while excising the aortic end of the duct.

The technic to be used must depend largely on the experience and skill of the operator. In discussing the ligation of large arteries in continuity, Reid³³ has shown that the size of the ligating material should increase in direct proportion to the size of the artery to be ligated. A fine ligature, allowing less time for repair of the devitalized segment, may cut through the wall of the vessel with the result that hemorrhage or re-establishment of the lumen occurs. It is also important that a ligature be tied in such a manner as to obliterate the lumen of the vessel without rupturing its media and intima. Careful obliteration of the ductus arteriosus with two or more ligatures of umbilical tape, reinforced perhaps with a mattress or transfixion suture, has appeared to be adequate in most instances (Figs 5 and 6). I have had no experience with the use of cellophane. Since the reaction from this material can be so severe as to cause obliteration of the aorta in experimental animals³¹ I would not consider using reactive cellophane for a ductus arteriosus until it has been adequately demonstrated that it will never cause injury to the adjacent nerves, great vessels and lung tissues. Such risk is not justified when other suitable methods are available.

As my experience with vascular surgery has increased I have become more and more convinced that division of a patent ductus arteriosus is preferable to its ligation, as long as there is no increased hazard to the patient. While the technic of Gross has been used with remarkable success by him, by Jones and by other surgeons, it is still true that an occasional death from hemorrhage has resulted. There is some danger that the clamps may slip or become dislodged after the duct has been divided and before the divided ends have been sutured. The first time I divided a ductus arteriosus its divided ends retracted between the jaws of the clamps. The profuse and terrifying hemorrhage which ensued was controlled with greatest difficulty. While this accident may be considered a reflection on my technic, others

have had the same experience (sometimes with a less favorable outcome) and it is one which I would not care to duplicate. It has also been observed that for exceptionally short ducts the Gross technic is not applicable.

Crafoord, by completely clamping the aorta, largely eliminates the danger of serious hemorrhage. But clamping the aorta of normal dogs for even short periods (ten to fifteen minutes) has frequently resulted in paralysis of their posterior extremities.^{2, 18} One must anticipate the possibility that this same serious complication may occur in humans who do not have the increased collateral circulation such as is associated with coarctation of the aorta.

In November 1946 Potts, Smith and Gibson³² described a clamp which they had devised in order to isolate a segment of the aorta while making a side-to-side anastomosis of the aorta to the pulmonary artery. This clamp permits some blood to flow through the aorta, around the compressed portion of its wall that is to be incised. It occurred to me that the same clamp would be applicable to the reverse procedure, division of a patent ductus arteriosus, and I have recently had occasion to use it in such an operation (Fig 7).

A five year old girl was operated on April 18, 1947. A posterolateral approach was used. After determining that an uncomplicated patent ductus arteriosus was present the segment of the

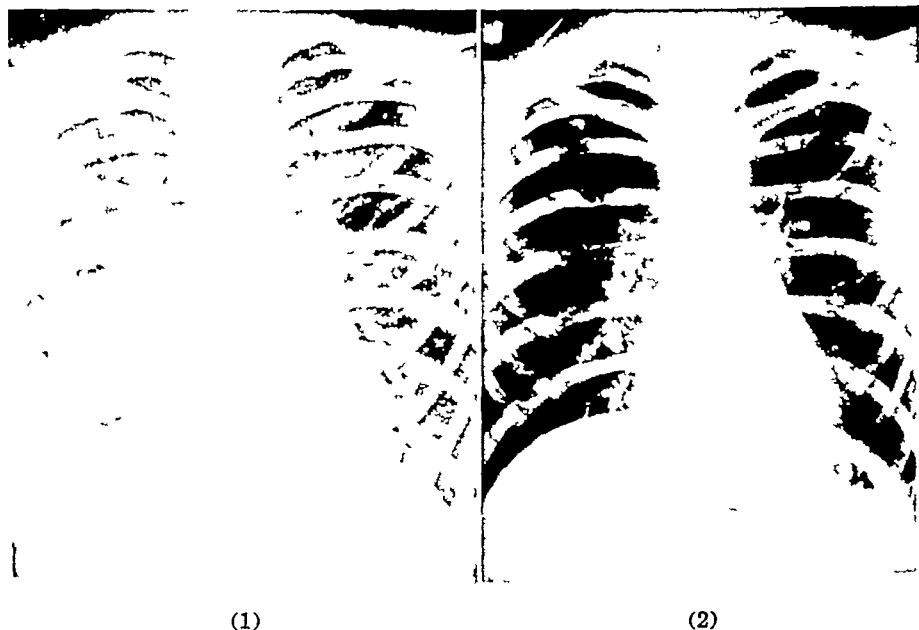


FIGURE 6 (Case No. 6) M.D. (1) PA chest film, 12-1-45, prominent pulmonary artery segment with increased vascular shadows extending into the lung fields. (2) PA chest film, 1-4-47, following ligation of patent ductus arteriosus.

aorta opposite the ductus was isolated, dividing one intercostal artery. The aortic clamp was then applied compressing the inferior wall of the aortic arch and interrupting the flow of blood through the ductus arteriosus, as evidenced by immediate disappearance of the thrill in the pulmonary artery. Isolation of the ductus, which was large both in diameter and in length, then proceeded with remarkable ease. Following novocaine infiltration, the vagus nerve was retracted gently with tape in order that it and the recurrent laryngeal nerve would not be traumatized. The pulmonary artery end of the duct was then doubly ligated and transfixed and the duct was divided between the ligatures and the clamp. The aortic end of the duct was sutured with a running mattress stitch of No 00000 Deknatel which approximated its walls, intima to intima. This was followed by a running glover's stitch. On slowly releasing the clamp a little oozing occurred near the middle of the suture line and an interrupted mattress suture was placed at this site before the clamp was finally removed. No further

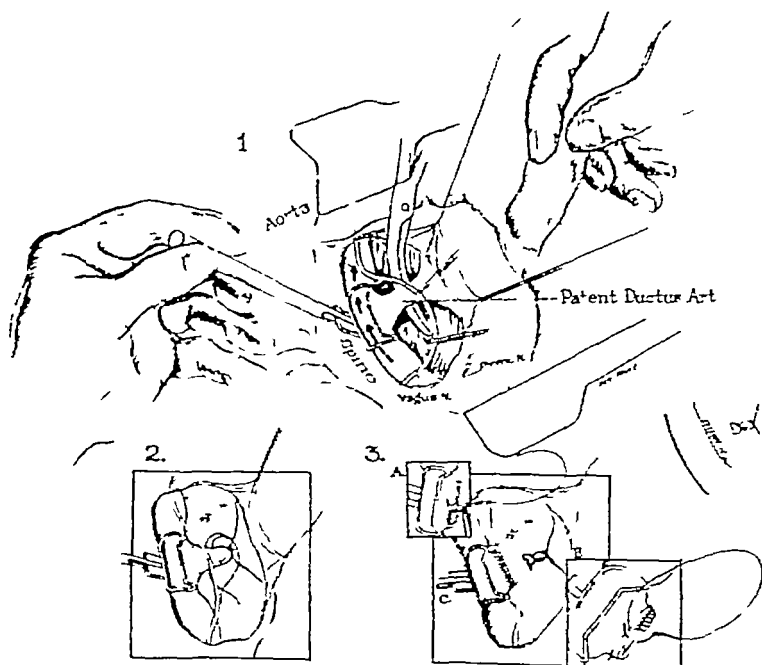


FIGURE 7 (1) Aortic clamp (Potts-Smith-Gibson) in place isolating aortic end of patent ductus arteriosus (2) Following ligation of pulmonary end of ductus a transfixion suture is being placed. Dotted line indicates site at which ductus will be divided (3) Suturing of aortic end of duct A - running mattress suture B - running glover's stitch. C - completed suture with aortic clamp still in place Some aortic circulation has been maintained
Insert Clamp removed

bleeding occurred. The pleura was reapproximated over the divided duct and the vagus nerve with a few interrupted chromic stitches and the chest wall was closed re-expanding the lung with catheter suction. Postoperatively the child had some hypertension but following a small venisection the blood pressure stabilized at about 120/80. Preoperatively the blood pressure was 110/0. Postoperative convalescence was smooth. No thoracenteses were required and there was no leg paralysis.

It is my impression that this technic offers the following advantages: 1) The danger of serious hemorrhage from the aorta is eliminated. 2) Isolation of the entire duct is relatively easy and rapid because of wider dissection and exposure with diminished danger from hemorrhage. 3) The vagus nerve is well exposed and can be retracted in such a manner that the recurrent laryngeal nerve is less likely to be injured during isolation of the duct. 4) The aortic end of the duct can be divided and sutured close to the aorta, or actually excised, so that no pouch or aneurysmal dilatation of the wall of the aorta will exist. 5) Clamps are not placed close to the suture line where interference with blood supply might promote necrosis and sloughing of the sutures. 6) This technic would probably be applicable to very short ducts or those with no length at all. If necessary the pulmonary artery could be temporarily occluded, proximal and distal to the duct, while the duct is divided and while its pulmonary end is sutured in the same manner as its aortic end. I propose this technic as one that is safe and more generally applicable than others that have been used.*

Complications

The operative and postoperative complications that have been or may be encountered include the following:

- 1 Hemorrhage
- 2 Shock
- 3 Vago-vagal reflexes
- 4 Cardiac arrest
- 5 Myocardial infarction
- 6 Hypertension (transient)

*A recent experience demands that I add a footnote in regard to this technic. A ductus arteriosus was divided using the largest available Potts clamp. The clamp was not large enough to isolate completely the aortic end of the ductus since the aorta was exceptionally large. A strip of umbilical tape was used to compress the non-occluded segment of the aorta against the clamp at its proximal end. This ill-advised maneuver resulted in a tear in the aortic wall which progressed proximally and resulted in uncontrollable hemorrhage.

Division of three additional ducts using the Potts clamp have confirmed the advantages of the technic. But the necessity for having a clamp of suitable size before proceeding with this type of operation must be emphasized.

- 7 Left recurrent laryngeal nerve paralysis
- 8 Phrenic nerve paralysis
- 9 Recanalization of the duct
- 10 Rupture of the duct or of an associated aneurysm
- 11 Aorto-bronchial fistula
- 12 Death from associated cardiac anomalies
- 13 Tension pneumothorax
- 14 Pleural effusion, hemothorax and fibrothorax
- 15 Empyema
- 16 Pulmonary embolism and infarction
- 17 Pulmonary atelectasis
- 18 Pneumonia
- 19 Bacterial endarteritis and septicemia
- 20 Keloid scar
- 21 Ligation of wrong vessel

John C Jones has presented an excellent review of complications encountered in the surgical treatment of sixty-one consecutive cases of patent ductus arteriosus,²² including fifty-three ligations and eight divisions. Since this report he has operated, by division, nine additional cases.²³ The series includes no cases in which bacterial endarteritis was known to exist prior to surgery. In the entire group (70 cases) there were two deaths, one surgical death from hemorrhage and cardiac arrest (1.4 per cent) and one late death from staphylococcus aureus endocarditis. In two cases there were large pulmonary hemorrhages several months postoperatively. In one of these an aorto-bronchial fistula was found and surgically repaired. In the other, presumed to have the same complication, spontaneous healing seems to be in progress. Ten of the fifty-three that were ligated have had more or less recurrence of the typical murmur, due either to incomplete occlusion of the vessel or to recanalization around the ligatures. Postoperative pulmonary atelectasis occurred in five cases, all responding to treatment. Empyema occurred twice, following pneumonia in one. In three cases there was recurrent laryngeal nerve involvement, transient in one, persistent (but with considerable voice improvement) in two.

Results

The results of surgical treatment of persistent patent ductus arteriosus and of the various technics employed cannot be finally evaluated for many years. It will take a half a century to determine incontrovertibly that the children subjected to surgery during these past eight years have had their life expectancy materially prolonged and that the surgical mortality, however small, has been amply justified by the promise of longer life and better health for those in whom the surgery is considered to have been successful.

Shapiro³⁶ has recently collected information on 643 surgically treated cases reported by forty-six surgeons. In seventeen of these no patent ductus arteriosus was found. A patent ductus arteriosus was ligated in 343 uncomplicated cases with a surgical mortality of 4.9 per cent and recanalization in 8.7 per cent. In eighty-eight cases complicated by subacute bacterial endarteritis surgical ligation resulted in a mortality of 28.4 per cent and recanalization in 4.5 per cent. Division of the ductus arteriosus was carried out in 182 uncomplicated cases with only one death and in thirteen infected cases with two deaths, one of which resulted from continued infection following successful section.

While one may suppose that published reports tend to reflect only the more favorable results and that early mishaps or failures tend to discourage the surgeon from further attempts and from recording his experiences, we may be encouraged by the realization that improvements and standardization in technics tend to lower the risk of any new surgical procedure. Particularly encouraging is the knowledge that surgeons, like Gross and Jones, who have had the widest experience in this field, have maintained a consistently low mortality, well below the average. It may be assumed that a growing number of surgeons, benefiting by their experience and training, will do the same.

In cases complicated by bacterial endarteritis and endocarditis the surgical mortality tends to be very much higher. It was in this group, however, that almost a 100 per cent mortality had formerly prevailed. As mentioned above, sterilization of the blood stream by antibiotic and other medical therapy does not protect against reinfection nor eliminate heart strain and the irreversible changes that occur. The indication for surgery in the presence of this complication continues to remain more urgent than in others. It is particularly heartening that an early surgical mortality of 50 per cent³⁵ in this group appears now to have been reduced to 28.4 per cent³⁶. Medical therapy, of course, should be used in conjunction with surgery.

All surgeons, cardiologists and pediatricians seem to have been favorably impressed by the changes that follow interruption of a persistent patent ductus arteriosus. The usual postoperative course is smooth. Children who previously were poorly developed will ordinarily show a rapid and marked gain in weight, irritability and fatigability diminish, and there is a gradual improvement in physical development, vigor, endurance and vitality. Any or all of the symptoms previously enumerated will tend to disappear.

My own experiences are summarized in Chart II and I shall present in greater detail a few of the cases in which conditions or complications may prove of particular interest.

B O, a twenty year old college student, was referred for treatment in May 1944, by Dr C P Wilson, a diagnosis of uncomplicated patent ductus arteriosus having been made

A left thoracotomy was performed on June 8, 1944 under cyclopropane anesthesia administered through an intratracheal tube A very large, short duct was isolated without mishap An attempt was made to divide the duct in the manner described by Gross,¹⁷ but following division of the duct its divided ends retracted between the jaws of the outermost clamps in such a manner that no cuff of tissue was available for suture In attempting to place an additional clamp proximal to the aortic end of the duct the remaining clamp came off completely leaving a wide open hole in the aorta, with a tremendous gush of blood shooting several feet into the air The bleeding was controlled by introducing a thumb into the aorta The vessel edges were finally re-approximated with the aid of heavy hemostats and closure was carefully completed with an interlacing suture In this emergency it was impossible to avoid some injury to the recurrent laryngeal nerve Similar difficulties were encountered with the pulmonary end of the duct However, here the closure was accomplished more easily and with relatively little blood loss During the operation 1,500 cc of blood were transfused The immediate post-operative course was smooth The patient was discharged from the hospital on the sixteenth postoperative day Four days after discharge he was readmitted to the hospital complaining of fever, chest pain, dry hacking cough, and slight hemoptysis The findings were compatible with a diagnosis of pulmonary embolism Thoracentesis yielded 450 cc of serosanguineous fluid No organisms could be cultured from this fluid At the time of thoracentesis 40,000 units of Penicillin were introduced into the pleural space and parenteral Penicillin therapy was started There was gradual improvement in the patient's symptoms, his temperature and pulse returned to normal On the fourteenth day of the second admission he was discharged home He remained on bedrest for one week and then started on graduated uptime He gained weight and gradually resumed normal activity For several months after operation he remained hoarse but the quality of his voice slowly returned to normal Five months after operation his blood pressure was 136/82 A soft systolic murmur to the left of the sternum persisted Fluoroscopic examination showed slight fullness of the shadow of the pulmonary artery When last seen, three years following surgery, he was working in Hollywood, leading a very active life which included sports such as swimming and basketball

Comment Despite previous testing of the clamps, the elastic bands placed about the clamp handles did not provide sufficient tension to prevent retraction of the vessel walls and dislodgement of the clamps Such a technical failure can usually be avoided However, I would advocate some modification of the technic which would completely obviate this hazard I believe that the clamp described by Potts et al,³² placed on the aorta opposite the aortic end of the duct, eliminates the danger of serious hemorrhage while the duct is being divided and while its divided ends are being sutured

The source of the postoperative pulmonary embolism was not

C H A R T I I

Case No	Sex	Age at opn	History	Physical Findings	BP Preop	BP Postop	EKG	Operation	Postoperative Course	Follow-up
1 P M	F	9	(1) Murmur at 4 mos (2) Fatigue (3) Nosebleeds (4) Weight loss	Machinery murmur second left interspace, accentuated P ₂ , prominent conus Corrigan pulse	124/60	130/85	Sinus arrhythmia normal axis	Anterior approach, ductus ligated in continuity with umbilical tape at each end	Venesection on 3rd postoperative day reduced BP 150/100 to 130/70	Relief of fatigability and irritability No nosebleeds for 1 year Increased activity
2 B O	M	20	(1) Heart murmur since birth (2) Inability to gain weight (3) Slight fatigability	Machinery murmur, right ventricular enlargement and hilar dance to fluoroscopy	115/55	136/82	Left axis deviation	Anterior approach, duct divided by Gross technique, serious hemorrhage from each end injury to recurrent laryngeal nerve	On 20th postoperative day patient had attack resembling pulmonary embolism	Relief of fatigue Weight gain Persistent systolic murmur Hoarseness, gradually cleared
3 C S	F	3	(1) Transient cyanosis with crying 2) Fainting spells (3) Fever	Machinery murmur and thrill, heart enlarged, capillary pulse, one of 4 blood cultures showed Staph aureus (contaminant?)	136/66	130/80	Normal axis	Anterior approach, duct ligated in continuity with umbilical tape at each end	Smooth Thoracentesis on 3rd postoperative day	Relief of fainting spells, increased exercise tolerance
4 J F	M.	25	(1) Blue @ birth (2) Fatigability (3) Pain in left hemithorax (4) Palpitation (5) Narcoleptic attacks	Continuous murmur, no thrill, capillary pulse, Corrigan pulse	130/94	120/84	Left axis deviation, negative T ₂	Anterior approach, duct 2 cm diameter ligated with umbilical tape at each end in continuity	Uncomplicated Thoracentesis (4th postoperative day) yielded 400 cc	Relief of "narcolepsy," increased exercise tolerance
5 J W	M	5	(1) Blue spell @ 2 mos (2) Fatigue (3) Dyspnea (4) Inability to speak clearly	Continuous murmur and thrill in 2nd left interspace, questionable apical systolic murmur pulmonary segment elongated & bulging to fluoroscopy	95/40	95/40	Normal axis	Anterior approach Non-patent ligamentum arteriosum, narrowing of ascending aorta. Probable aortic septum defect Exploration only	Uncomplicated.	Repeated respiratory infections. Poor progress in school Impaired speech
6 M D	F	10	(1) Fatigability (2) Irritability (3) Recurrent respiratory infections (4) Eczema—food allergies	Machinery murmur and thrill in 2nd left interspace widened pulse pressure	120/0	106/75	Normal axis	Anterior approach short wide ductus ligated in continuity with umbilical tape at each end.	Uncomplicated	Relief of fatigability and irritability Still repeated upper respiratory infections

7 J.S.	F	19	(1) Murmur @ 1 yr (2) Palpitation (3) Precordial pain on exertion (4) Dyspnea (5) Ankle edema	Machinery murmur and thrill in 2nd left interspace capillary pulse right ventricular outflow tract and pulmonary artery enlarged	110/68	122/80	Normal axis	Anterior approach duct 2 cm in diameter ligated in continuity with umbilical tapes at each end. Marked dilation of pulmonary artery over which a thrill was still palpable after the duct had been securely obliterated	Uncomplicated	Incisional keloid Dyspnea and palpitation relieved. Persistent systolic murmur over 2nd left inter-space
8 F.S.	F	9	(1) Murmur @ 9 yrs	Machinery murmur 2nd left interspace capillary pulse, exaggerated hilar lung markings	108/50	120/80	Normal axis	Anterior approach, ductus ligated with heavy silk and divided after hemorrhage from posterior wall. Aorta clamped 35 minutes during division	Uncomplicated EKG changes interpreted as myocardial infarction in vector precordial leads	Well no evidence of paralysis, EKG reverted to normal
9 D.F.	F	2	(1) Low vitality (2) Dangerously ill with recurrent respiratory infections (3) Failure to grow normally	Systolic murmur and thrill over 2nd and 3rd left interspaces. No diastolic component. Marked enlargement of heart	116/26	—	Normal axis	Patient expired due to cardiac arrest during isolation of ductus	Autopsy atelectasis of both lungs Patent ductus arteriosus sole cardiovascular anomaly All chambers of heart enlarged	
10 J.B.	M	22	(1) Murmur found at Army examination (2) Fever (3) Pain in left side of chest (4) Loss of weight and strength (5) Dyspnea	Continuous murmur in 2nd and 3rd left interspaces, apical systolic murmur Dullness and diminished breath tones over left hemithorax	130/100	124/96		Posterolateral approach. Fibrinous deposition on left lung decorticated. Long ductus ligated in continuity with umbilical tape	Uncomplicated Drainage tubes removed on second postoperative day	Improved weight, strength and pulmonary function
11 D.C.	M	9	(1) Spells of cyanosis during first 2 mos of life (2) Easy fatigability	Systolic and early diastolic murmur in 2nd and 3rd left interspaces	120/70	116/80	Right axis deviation	Anterior approach, ductus ligated in continuity with umbilical tape at each end	Uncomplicated	
12 P.N.	F	5	(1) Murmur present since birth (2) Subnormal physical development	Continuous murmur in 2nd and 3rd left interspaces. Palpable thrill. Corrigan pulse	110/0	120/80	Right axis deviation	Posterolateral approach. ductus divided using Potts-Smith-Gibson clamp on aorta	Uncomplicated	

definitely established There was no evidence of phlebothrombosis It is possible that trauma, contingent on the operative difficulties, favored the formation of a thrombus at the pulmonic end of the divided ductus and that this thrombus later became dislodged The fact that only the left lung was involved is compatible with this explanation A pre-existing bacterial endarteritis had not been diagnosed or suspected

J F, a twenty-five year old fireman, was referred for treatment in June 1944, by Dr Homer Rush The patient complained of attacks of listlessness since the age of fourteen Typically the attacks occurred daily at about 10 00 A M and 2 00 P M Occasionally the patient would have difficulty remaining awake while driving a car and at other times He also noted occasional attacks of momentary mental confusion He had been told that he had narcolepsy and benzedrine, ten milligrams two or three times daily, had partially controlled the symptoms His mother stated that he was a blue baby at birth and that cyanosis persisted for the first ten days of life There had been no cyanosis since that time Slightly increased fatigability was noticed and he complained of an ill-defined pain in the left upper part of his chest There was occasional slight faintness but no actual loss of consciousness Although the diagnosis of patent ductus was not clearcut the patient repeatedly insisted that exploration be performed to determine whether or not a correctable defect were present

On April 17, 1945 a patent ductus arteriosus, measuring two centimeters in diameter, was ligated with two widths of three-eigh inch umbilical tape The postoperative course was smooth Since surgery the patient has been completely relieved of his previous symptoms His work in a new occupation as a medical illustrator shows considerable aptitude and promise

Comment This patient had read a good deal of medical literature concerning patent ductus arteriosus and he was convinced that obliteration of a shunt would cure his "narcolepsy" His previous symptoms had prevented him from undertaking anything which required sustained effort or concentration He was handicapped considerably in his University studies, in his choice of occupation and in pursuance of normal activities It may be surmised that cerebro-vascular circulation may improve following elimination of a ductal shunt and that this accounts, at least in part, for the gratifying result obtained in this case

F S, a nine year old girl was referred by Dr Roderick Norton of Tacoma, Washington A diagnosis of uncomplicated patent ductus arteriosus had been made

Operation was performed on September 2, 1946 through an incision in the second left interspace There was a large, short ductus arteriosus and on exposing its presenting surface it was immediately noted that the duct had an extraordinarily thin wall which bulged outward when supporting structures had been removed Because of this finding extreme caution was observed Nonetheless, when the duct had been partially

dissected, there was a sudden profuse hemorrhage from its posterior aspect. The duct being extremely short it seemed unduly hazardous to proceed immediately with its isolation since further tearing of its wall and dangerous blood loss were likely to ensue. While bleeding was controlled with digital pressure the aorta was isolated and occluded, proximal to the duct, with a large hemostat. Dissection was then continued until the duct was isolated. After both ends of the duct had been ligated and transfixed the vessel was divided. The aortic clamp was then released producing a transitory fall in the blood pressure which was not marked. Further bleeding from the aortic end of the duct required re-application of the aortic clamp while supporting sutures were introduced. The aorta was occluded for a total of thirty-five minutes. Postoperative mucus accumulation in the tracheobronchial tree required removal by suction. An electrocardiogram taken seven days after the operation showed changes consistent with left ventricular ischemia. The patient had no complaints referable to the heart following operation and electrocardiographic changes have since reverted to normal.

Comment As reported by Blalock and Park² and by Gross and Hufnagel¹⁸ prolonged occlusion of the aorta in dogs has often resulted in paralysis of the posterior extremities. In this case the aorta was clamped for a period of twenty minutes and again for a period of fifteen minutes. Fortunately no evidence of any paralysis resulted. I understand that Crafoord clamps the aorta routinely when dividing a patent ductus arteriosus and apparently he has had no complications when employing this technic. Use of the clamp described by Potts, Smith and Gibson³² should provide additional safety in a procedure of this type. We have been most interested in the temporary electrocardiographic changes that occurred in this case and have not, as yet, arrived at a satisfactory explanation for these. They may have resulted from a transient coronary insufficiency resulting from a fall in blood pressure when the aortic clamp was removed.

D F, aged two and one half years was referred by Dr. Frank Maddison of Tacoma, Washington. She was admitted to Doernbecher Hospital because of slow growth and severe respiratory infections. She had had two severe attacks of respiratory infection with fever, nasal obstruction, bronchitis and rapid breathing. During these attacks the child was very ill, her temperature rising as high as 106 rectally. According to her family physician on each occasion she had "almost succumbed." The child often became very pale and white upon over-exertion but there was never any definite history of cyanosis. She had been seen by Dr. Helen Taussig who had confirmed a previous diagnosis of patent ductus arteriosus and had advised early surgery. Electrocardiographic and fluoroscopic findings indicated that all four chambers of the heart were markedly enlarged. In view of the enlarged, dilated heart and history of severe dyspnea, the patient was digitalized before operation.

Thoracotomy was carried out through incision in the second left anterior interspace. The pulmonary artery was markedly dilated. There was a continuous machinery thrill felt over the pulmonary artery and aortic

arch A patent ductus arteriosus was partially isolated About one hour after the induction of anesthesia the instruments were removed from the chest so that the lung could be re-inflated Before the lung could be expanded, it was noticed that the heart had stopped completely and suddenly Slight irregular systoles involving the whole heart could be palpated, but there was no demonstrable peripheral pulse or blood pressure Cardiac massage and bag breathing were started Fifty-five minutes after cardiac massage had been instituted further attempts at resuscitation were abandoned

Comment In preliminary correspondence with the child's family physician I had urged that every attempt be made to carry her along without surgery for at least another year or two Having followed her closely from birth, he stated that "on two occasions she contracted a mild upper respiratory infection and almost succumbed each time," and he was convinced that surgery would have to be performed soon, if at all Dr Taussig had apparently concurred in this opinion

The cause for sudden cardiac arrest is still obscure In view of the systoles involving the whole heart, it is improbable that the failure was on the basis of ventricular fibrillation The possibility of complete sino-auricular block should be considered Autopsy showed massive bilateral pulmonary atelectasis, hyperemia and edema of the lungs, petechial hemorrhages into the pleura and a patent ductus arteriosus approximately 12 mm in diameter which was the only congenital cardiac defect There was marked dilatation and hypertrophy of all chambers of the heart

J B, a twenty-two year old truck driver, was referred for treatment by Dr R E Herron in August 1946 He complained of pain in the left side of the chest posteriorly, loss of weight and strength and slight morning cough, which was not productive He first learned that he had a heart murmur when he was rejected for army service In June 1946 he had had an acute attack of fatigue, chills, fever and loss of appetite The day following onset of this illness he noticed pain in the left lower part of his chest He was admitted to a local hospital where he was told that he had "pneumonia" He required oxygen for the first two days Penicillin was given for four weeks Nine days after the onset of his illness a left pleural effusion was found This was aspirated numerous times His temperature gradually returned to normal He was discharged after three weeks hospitalization He gained weight and strength but continued to have a slight non-productive morning cough and dull constant pain in the left lower part of his chest posteriorly The pain was worse when the patient was fatigued He was admitted to my service six weeks after the onset of his febrile illness

Examination showed a tall, thin white male There was limited respiratory excursion of the left hemithorax and flatness to percussion in the left lower lung field Breath tones were weak and crepitant rales were heard occasionally in this area Pulse rate was 128 A continuous machinery-like murmur was heard in the second and third left inter-spaces No thrill was felt Following admission to the hospital he had

recurrent attacks of vomiting and fever Thoracenteses yielded relatively small amounts of thin bloody fluid The fluid showed no organisms on smear and culture Cultures for tubercle bacilli were negative A diagnosis of tuberculous pleurisy with effusion was considered until intradermal tuberculin tests were found to be negative, even in concentrated dosage He gained weight on bedrest and following a final febrile episode of short duration he was discharged home He was allowed to increase his activities gradually and remained asymptomatic However a marked contracture and fixation of the left hemithorax persisted The lower portion of his left lung field remained radio-opaque, flat to percussion and breath sounds could not be heard in this area

Six months after discharge he was readmitted to the hospital On January 16, 1947 under endotracheally induced cyclopropane anesthesia, a thoracotomy was performed through the bed of the resected fourth rib using a posterolateral approach The left lung was enveloped by a thick and very dense fibrinous membrane measuring two or more centimeters in thickness There was no free fluid

The lung was completely freed from the chest wall and then, carefully, the visceral portion of the closely adherent fibrotic membrane was removed The surface of the lung under the membrane appeared dark and airless but with slight positive pressure, applied by the anesthetist, good aeration and re-expansion was gradually obtained The more accessible areas of the parietal portion of the membrane were then removed with the hope that increased mobilization of the rib cage might result The diaphragm was elevated and fixed, the costophrenic angle being completely obliterated with organized fibrin This area was practically inaccessible from the site of exposure and little attempt was made to free the edges of the diaphragm

A ductus arteriosus was found and isolated It had considerable length but was only about one centimeter in diameter Dissection around the duct was rather difficult because of the marked fibrous tissue reaction that extended deep into the mediastinum When both ends of the duct were obliterated with $\frac{3}{8}$ inch umbilical tape ligatures, the thrill, previously felt over the pulmonary artery, disappeared immediately Additional measures seemed unnecessary and the wound was closed while lung expansion was maintained, two intercostal tubes, anterior and posterior, being left in place for postoperative suction drainage These tubes were removed on the third postoperative day when breathing exercises were instituted

Convalescence was entirely uneventful and the patient returned in about six weeks to his former occupation, i.e. truck driving

Comment This patient's febrile illness, pleural exudate and fibrothorax have never been adequately explained Pathological examination of the membrane showed nothing to suggest a tuberculous etiology and tuberculin tests had been repeatedly negative One possibility is that he had a bacterial endarteritis complicating his patent ductus arteriosus, that the blood stream infection had responded to the Penicillin given elsewhere, and that the episodes recurring after we saw him represented pulmonary embolism from breaking off of residual vegetative material in the pulmonary artery

DISCUSSION

Unequivocally it may be stated that the surgical treatment of patent ductus arteriosus is indicated under certain conditions 1) in the presence of retarded development, 2) when evidence of heart strain occurs, 3) in the presence of a complicating subacute bacterial endarteritis

In addition, the concensus appears to be that all children and young adults, who have an uncomplicated patent ductus arteriosus the spontaneous obliteration of which is unlikely to occur, are candidates for surgical treatment in order that the hazards of this condition may be prevented and the survival expectancy prolonged Elective surgery in these cases should be postponed until after four years of age and is most readily performed between the ages of five and ten

The surgical mortality in the series collected by Shapiro was about 5 per cent, and varies indirectly with the skill and experience of the surgeon In cases complicated by bacterial endarteritis, the surgical mortality is still high (28.4 per cent) Despite the fact that chemotherapeutic and antibiotic agents have been of value in the treatment of bacterial infection of the blood stream, even this mortality offers less hazard to the patient than failure to eliminate the abnormal shunt

SUMMARY

The literature concerning patent ductus arteriosus is briefly reviewed

A persistent patent ductus arteriosus may be eliminated by surgical division or ligation When the duct remains open after the first year of life, spontaneous obliteration is not likely to occur Unless associated with other cardiovascular anomalies, its surgical treatment in children over the age of four years should be considered in order that life expectancy may be increased The surgical mortality in skilled hands is sufficiently low to justify this conclusion

Since recanalization has frequently followed ligation of a patent ductus arteriosus, division is considered the procedure of choice A modified technic for division of a patent ductus arteriosus is presented This technic is considered to have several advantages, being safer and more widely applicable than the technics now in use

Twelve cases are reported in which the diagnosis of patent ductus arteriosus was made and operation performed In one case the preoperative diagnosis of patent ductus was in error There was one surgical (anesthetic?) death

Other cases reported in detail include one in which massive hemorrhage occurred following division of the duct and in which convalescence was complicated by the occurrence of pulmonary emboli, one in which the aorta was clamped for a total of thirty-five minutes while hemorrhage was being controlled and the duct divided, one case in which attacks resembling narcolepsy were apparently relieved following ligation of the duct, and one in which decortication of the lung was performed at the time of ductus ligation

I am indebted to Dr Elton Watkins, Jr for assistance in reviewing the cases herein reported and to Mr Jack Fruitt for the illustrative drawings

RESUMEN

Se ha revisado brevemente la literatura relativa al conducto arterial persistente

Puede eliminarse un conducto arterial persistente por medio de la división o la ligadura quirúrgicas. Cuando el conducto persiste después del primer año de vida, es improbable que ocurra la obliteración espontánea. A menos que esté asociado con otras anomalías cardiovasculares, debe considerarse el tratamiento quirúrgico en niños de más de cuatro años a fin de poder prolongar sus expectativas de vida. La mortalidad quirúrgica en manos expertas es lo suficientemente baja para justificar esta conclusión.

Ya que la recanalización ha seguido frecuentemente a la ligadura del conducto arterial persistente, se considera que la división es el procedimiento preferible. Se presenta una técnica modificada para la división del conducto arterial persistente. Se considera que esta técnica ofrece varias ventajas, presenta menos peligros y es de aplicación más extensa que las técnicas ahora empleadas.

Se informa sobre doce casos en los que se hizo el diagnóstico de conducto arterial persistente y se ejecutó la operación. En un caso el diagnóstico preoperatorio de conducto persistente fue erróneo. Hubo una muerte quirúrgica (anestésica?).

Otros casos sobre los cuales se informó en detalle incluyen uno en el que ocurrieron hemorragias masivas subsiguientes a la división del conducto y en el que embolias pulmonares complicaron la convalecencia, uno en el que se pinzó la aorta por un período total de treinta y cinco minutos mientras se dominaba la hemorragia y se seccionaba el conducto, un caso en el que la ligadura del conducto aparentemente alivió ataques parecidos a narcolepsia y uno en el que se llevó a cabo el descortezamiento del pulmón al mismo tiempo de la ligadura del conducto.

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D i s c u s s i o n

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Although it is felt that division and suture of the ends of the ductus will give the best anatomical results, there are cases in which the ductus is too short to carry out such a procedure and there is always the hazard of severe uncontrollable hemorrhage should one of the clamps be dislodged. Consequently, it is advisable

to ligate the ductus by "purse string" suture and mattress stitches as proposed by Blalock. Since the introduction of the aortic clamp, devised by Potts, Smith and Gibson, it is evident that this will add safety to division and suture of the ductus as the danger from hemorrhage from the aortic end should be almost eliminated.

The outstanding work of Maud Abbott in showing that 50 per cent of these patients die before the age of thirty, and outstanding reports by others, prove that this anomaly definitely shortens life. This is the prime reason for operation in an effort to prolong life expectancy.

Some of these cases develop bacterial endarteritis which is an indication for surgery, even should penicillin therapy be effective. The operation of Potts in anastomosing the aorta to the pulmonary artery produces a patent ductus syndrome and undoubtedly some will develop an endarteritis. So far none have been reported in the Blalock or Pott's operations. It will be interesting to see what this percentage will be, but even if it runs 5 to 10 per cent, that is no contraindication for relieving the cyanosis and improving the heart status in the Tetralogy of Fallot.

Surgery is usually best carried out between the ages of three and twelve, and in experienced hands gives excellent results with a low mortality.

Closure of Cavities in Pulmonary Tuberculosis Produced by Immobilization of Both Lungs*

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Introduction

Although striking medical advances have recently taken place in the treatment of infection by antibacterial agents, the use of rest in chronic pulmonary tuberculosis is still of great importance. In this paper the initial results of treatment with the lung immobilizing chamber will be described in 7 patients with persistent pulmonary cavities. In previous reports the principles by which complete lung rest was produced with simultaneous maintenance of normal pulmonary ventilation have been described.¹⁻⁸ Recent summaries⁹⁻¹⁰ of the clinical results of treatment in 12 cases of advanced tuberculosis showed that 6 obtained arrest of their disease with ability to work, 1 was markedly improved, 3 showed slight to moderate temporary benefit and no change occurred in 2.

Local rest of the lungs was achieved in this method without collapse therapy or alteration of the normal lung or chest structure. The mechanism by which adequate pulmonary ventilation was provided included use of the principle of alternating pressure, described by Thunberg¹¹ as a method of resuscitation. By mechanically varying the pressure within an enclosed chamber approximately one-seventh of an atmosphere 24 times a minute, air was compressed and decompressed within an enclosed space in which the patient lay, resulting in a tidal air of approximately 300 cc. In order to prevent an earlier arrival of pressure to the outer chest wall than to the inner surface of the thorax the resistance of the respiratory passageway had to be counterbalanced in a precise manner, in the final arrangement the incoming air was led into the head chamber and then, momentarily delayed by a partition, entered the body compartment.¹⁻⁸ Cessation of lung movement was thus accomplished by simultaneously equalizing the pressure on both sides of the chest wall,

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the chamber being described as an equalizing alternating pressure chamber, or, recently, as the lung immobilizing chamber

The partition, which surrounds the neck of the patient, is lowered to produce differential pressures between 4 and 12 cm of water. In most cases, the addition of 5 cm pressure during the positive cycle in the head end of the chamber is adequate to overcome the resistance of the tracheo-bronchial tree. In patients with pulmonary fibrosis or those in whom narrowing of the bronchial tree has taken place as a result of chronic inflammation, higher differential pressures are required. When marked pulmonary emphysema is present, it is impossible to delay the air wave long enough to achieve a simultaneous application of equal pressures to both surfaces of the chest wall. At present this therapy is not attempted when a pressure higher than 15 cm of water is required to overcome tracheo-bronchial resistance.

Method of Treatment

The method of treatment with the lung immobilizing chamber has become simplified so that it can be carried out at a private residence as well as at an institution. Of most importance is the training of the patient during the first week, during which he learns to stop breathing without movement of the chest. Subsequently, the chest is immobilized *without* conscious or voluntary effort for four months or longer. However, in cases in which inadequate supervision is given during the first week, spontaneous breathing may take place irregularly thereafter.

When the patient is placed in the chamber the pressure is turned to plus and minus 55 mm of mercury at a rate of 26 times a minute. During the first period of ten minutes in the apparatus the patient is told to take three or four breaths, to exhale normally and then cease breathing. At the end of a minute or two he is apt to breathe, when he is told to take three or four breaths again and then stop breathing, with the suggestion that he will not require any voluntary breathing. During this time the chest is observed with the water manometer set at 5 cm pressure. In most patients the first learning period is not prolonged beyond one hour. If it should be observed that the patient tends to enlarge his chest during the cycle of negative pressure, i.e., when the pressure indicator is turning from the positive to the negative side, he is asked to take short breaths during the opposite cycle of pressure, namely, the positive cycle. This is usually accomplished when the operator raises his hand as the pointer leaves from the negative to the positive side and says, "Breathe in." That method is usually not necessary except in cases that have a considerable amount of pulmonary fibrosis. During the follow-

ing week the amount of time in the chamber is increased one hour a day and at the end of ten days the patient is placed on a schedule of ten hours daily, usually three hours in the morning, 4 hours in the afternoon, and three hours in the evening

During the first week costal respiration is dispensed with and in the following week the absence of diaphragmatic movement is noted. It is unnecessary to lecture the patient on persistent movement at the lower border of the ribs during the first week as this spontaneously disappears at the end of seven to ten days. There may be a slight movement observed over the surface of the abdomen as a result of compression of gas in the intestines, it is not a sign of movement of the diaphragm as this pressure is counteracted by an opposing pressure on the upper surface of the diaphragm from air entering the chest, as has been previously demonstrated by repeated x-ray exposures on the same film in these patients.

The effect of alternating pressure on the ear is similar to that experienced in a rising and descending elevator, it may at first be uncomfortable but in our patients it has not persisted as a source of discomfort after the first day or two. Congestion in the sinuses may temporarily take place but it also is not a handicap to the treatment. In a few instances the therapy has been discontinued for one or two days and recommenced without further difficulty. No other side-effects have been encountered except the unique development of mental and bodily relaxation that generally takes place in the chamber.

When patients have learned to dispense with voluntary breathing, the impulse for spontaneous muscular movement is remarkably diminished, in some cases no movement of the arms or legs is observed for hours at a time. It is of considerable interest that boredom is not complained of and that patients are for the most part willing to carry on the treatment without entertainment. In a few cases the radio is desired and ear-phones are used with them. When the patients observe that their chest is not moving, by placing their hands on the thorax and abdomen, their own faith in the chamber increases and their morale during the treatment is usually high. The feeling of claustrophobia may be anticipated by the patient, but as soon as ventilation of their lungs is performed by the apparatus without voluntary breathing this notion completely disappears. In no patient has it been a problem.

Although ten hours a day of residence in the chamber is considered the optimum time, recovery took place in one patient following a course of eight hours a day for three months. However, one patient, who had a large cavity in the left upper lobe, was treated for five hours a day, in an experimental trial of the

duration of treatment, without a favorable result. A succeeding trial of ten hours a day was followed by closure of cavity with the development of negative sputum in a period of four months. Since absence of lung expansion prevents inspiratory enlargement of the cavity, the check-valve mechanism responsible for maintenance of cavity in some cases is eliminated only during the time in the chamber. In projected investigation the value of longer periods of lung immobilization will be tried.

The patients are generally advised to take a high protein, low carbohydrate diet, as recommended by Sandler and Berke¹²

Results

The case histories of the patients treated in this series will be presented. In 6 of 7 completed cases the treatment resulted in closure of cavity with negative sputum. In all these patients pneumothorax had been tried, either without initial success, or with reappearance of cavities following termination of pneumothorax.

CASE REPORTS

Case 1. Woman, age 27. The diagnosis of pulmonary tuberculosis was made when the patient was 17 years old at which time a right therapeutic pneumothorax was induced because of a large apical cavity. One year later the development of a fresh cavity on the left side was followed by the maintenance of bilateral pneumothorax. Three years before admission the left pneumothorax was abandoned and one and one-half years later a cavity appeared at this site. After a period of nine months she was admitted to the Presbyterian Hospital. Physical examination revealed evidences of involvement of each apex, but only the left side appeared active. Planigraphic x-ray films revealed a cavity 4 cm in diameter at the left apex with a second cavity below and contiguous to it, 2.5 cm in diameter, near the hilar region, in addition to many areas of fibro-calcified disease. Sputum was positive for tubercle bacilli, the sedimentation rate was 20 mm./hr. She was afebrile.

The pneumothorax on the right side was allowed to re-expand and chamber treatment was started. After four days of residence in the chamber the patient was completely immobilized. At the end of four months treatment, ten hours daily, the excavation on the left side was no longer visible by stereoscopic and planigraphic x-ray films. The concentrated sputum was negative for acid-fast bacilli and then all cough and expectoration disappeared. The patient was released to continue bed rest at home and she has remained symptom-free with no change in the x-ray examination of her chest during the following sixteen months.

Case 2. Woman, age 38. The patient had had diabetes since the age of 24. Twelve years ago pulmonary tuberculosis was diagnosed, for which a right therapeutic collapse was induced, and, shortly thereafter, collapse of the left side, because of cavitation in the left upper lobe. Two and one-half years ago a cavity appeared on the left side following termination of pneumothorax four years previously. A phrenic crush was performed which was followed by no change in the disease and one year

later she was admitted for chamber therapy. The sputum was positive for tubercle bacilli. X-ray examination of the chest revealed a cavity 3 x 4 cm in the left posterior axilla which contained a fluid level. The patient ran a minimal fever of 99.6 to 100° F by rectum. Sedimentation rate 25 mm./hr. Immobilization of both lungs took place promptly on the first day in the chamber. After two months the cavity had decreased to one-third its former size. Because of the persistence of a fluid level the patient was treated with inhalation of nebulized 1 per cent neo-synephrine, 0.5 cc tid. At the end of 18 weeks' treatment, 10 hours daily, the cavity had been replaced by a dense shadow approximately 1 x 1 cm in diameter at the extreme periphery of the left upper lung.

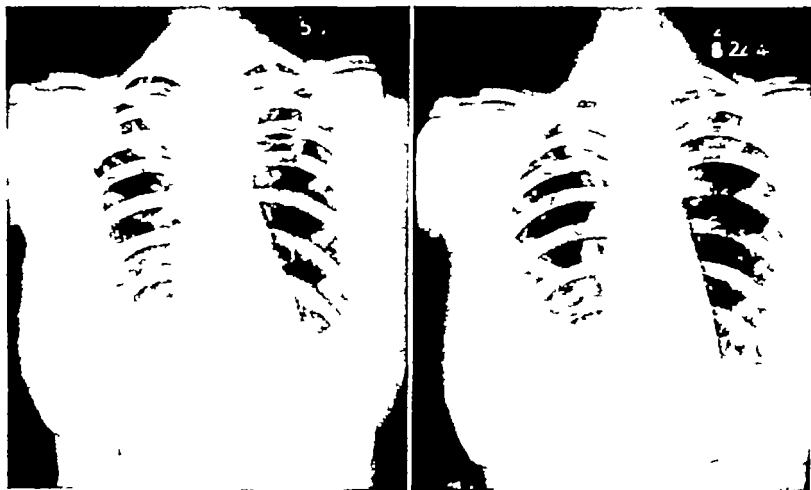


FIGURE 1 X-ray films before and after 3½ months treatment

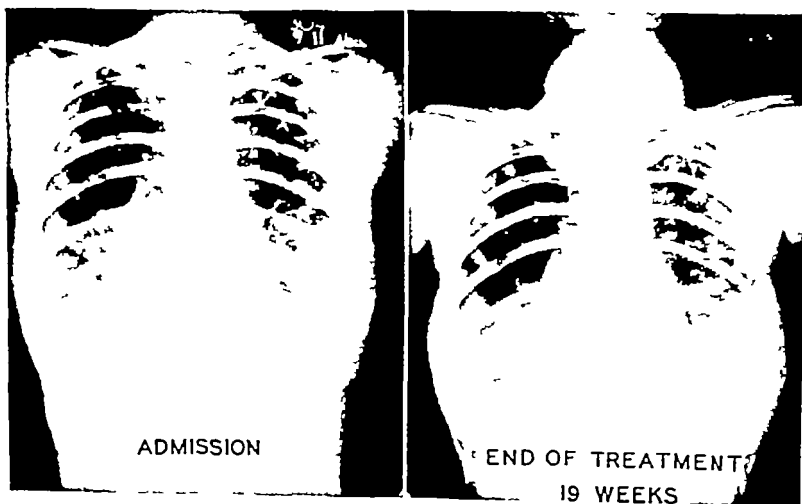


FIGURE 2 X-ray films before and after 19 weeks treatment

field Sputum and gastric lavages were negative for acid-fast bacilli. Films taken three, four and five months after discharge from the hospital showed no significant change but x-ray films 7 months after discharge showed a disappearance of the above described shadow. The patient has no cough or expectoration.

The disappearance of the two cavities in the first case, as revealed by the x-ray photographs (Fig 1), is an illustration of the favorable result of immobilization of the lungs in a patient in whom previous bed rest had been followed by no improvement. In the second case, as the cavity became smaller, a density in the x-ray film which eventually replaced the rarefaction finally disappeared. The accompanying stereoscopic and planigraphic x-ray films (Figs 2 and 3) illustrate the changes mentioned above.

Case 3 Man, age 30 years, was found to have tuberculosis one year and eight months before treatment. A cavity was noted in the right upper lobe with some extension to the left mid-lung. He was treated at first with rest and pneumothorax on the right, and later on the left, but adhesions prevented a satisfactory collapse and sputum remained positive. Ten months later he was admitted to the House of Rest where a 4 cm cavity was found in the first costal interspace on the right and moderate infiltration in the left mid-lung field. The bilateral contra-selective pneumothoraces were abandoned and the lungs re-expanded. Patient was afebrile.

The patient was quickly immobilized and at the end of a week was in the chamber ten hours a day. The cavity in the right lung gradually diminished in size, the sputum was decreased, but continued to be positive until he had five months of treatment when it became persistently negative. The cavity had disappeared, treatment discontinued, the patient was on bed rest for four months, ambulatory for eight months.

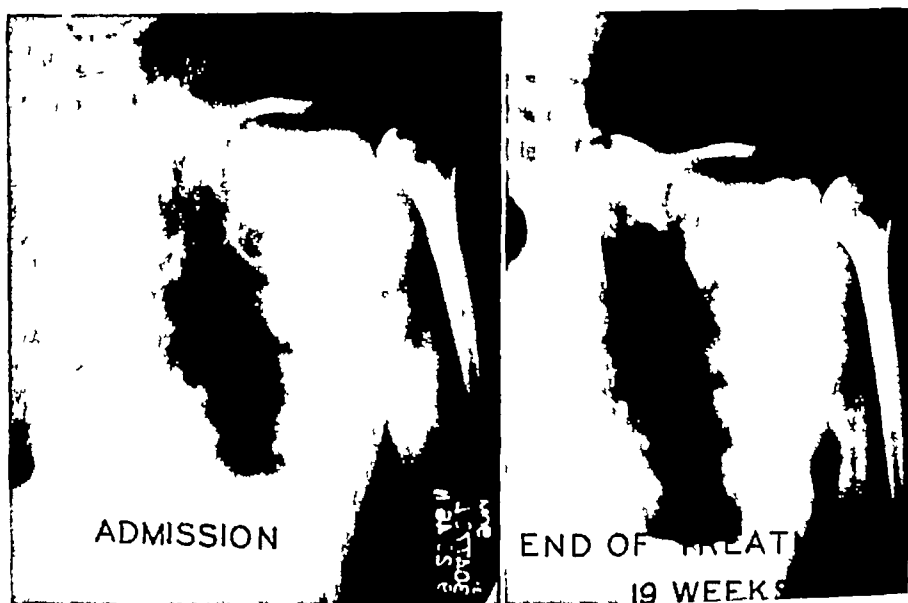


FIGURE 3 Planigraphic x-ray films before and after 19 weeks treatment

Case 4 Woman, age 26 years, who had a history of tuberculosis for two years Pneumothorax was attempted on the left without success, but the patient recovered under conservative therapy and was apparently well for one year and nine months when the disease in the left lung reactivated and revealed a cavity with positive sputum She was admitted to the House of Rest two months later where a cavity 3 cm in diameter was found in the second interspace on the left with positive sputum. The patient was afebrile Since the cavity did not respond to bed rest she was begun on immobilizing lung treatment six months later She became immobilized in one week The sputum became negative two weeks after treatment was started and has continued to be negative At the end of five months the cavity is no longer visible A small shadow about 4 mm in extent was seen in the x-ray at the site of the original cavity She was on bed rest for four months now ambulatory

Case 5 Woman, age 26 years, whose pulmonary tuberculosis was diagnosed following a hemoptysis five years prior to admission At that time she was found to have pulmonary tuberculosis with bilateral cavitation Pneumothorax was induced on the left and six months later on the right The bilateral cavitation fluctuated markedly in size and the patient's sputum continued positive for a year when it became negative for one year, after which time the cavity in the left lung reopened The pneumothorax on the left, and a year later because the cavity in the right reopened, the right pneumothorax were abandoned At the time of treatment she had a 6 cm cavity in the right mid-lung at the level of the third inter-costal space and a 3 cm cavity in the second left costal interspace The sputum was positive Although considerable reduction in respiratory motion was obtained, complete immobilization was never secured because of pulmonary emphysema She was, however, given chamber treatment The cavity in the right lung finally reached one-quarter of its previous size but the cavity in the left lung which was at first stationary began to increase The chamber treatment was finally abandoned at the end of six months

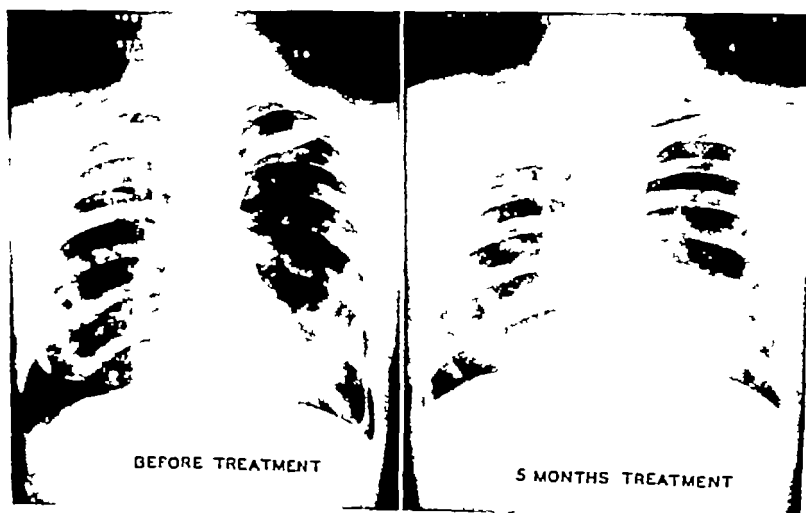


FIGURE 4 X-ray films before and after 5 months treatment

The accompanying x-ray films (Figs 4 and 5) illustrate the closure of cavity as a result of immobilizing lung treatment in Cases 3 and 4

Case 6 Woman, age 52 years The diagnosis of pulmonary tuberculosis was made six years ago Pneumothorax was induced on the left at that time and was successfully maintained for two years when it was optionally abandoned About three years later the disease in the left lung



FIGURE 5 X-ray films before and after 4½ months treatment

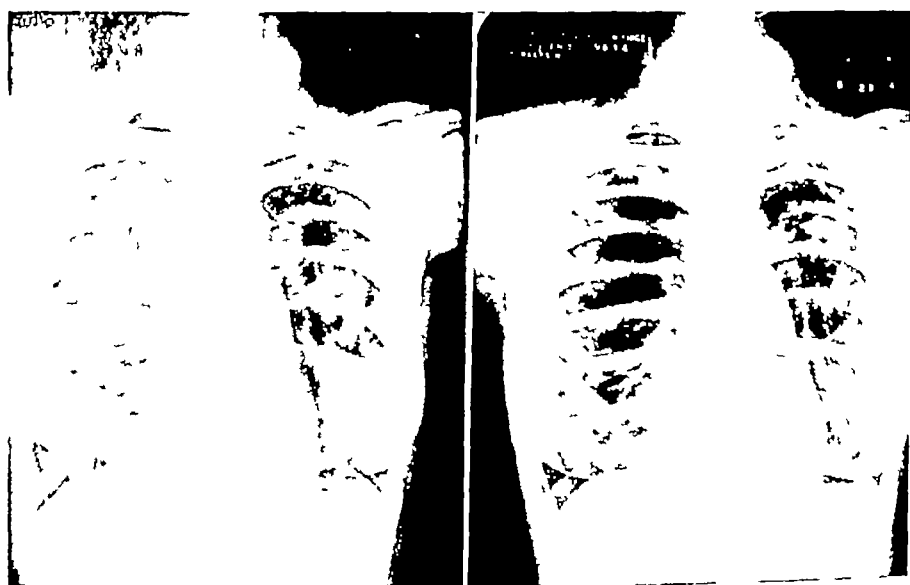


FIGURE 6 X-ray films before and after 4 months treatment and 2 months bed rest

became re-activated with evidence of a cavity in the third interspace and the sputum was positive. She was admitted to the House of Rest where it was found that a small scattered nodulation extending from the first to the third intercostal space was present on the left with a 4 cm cavity over the second rib. The patient was afebrile.

Pneumothorax was unsuccessfully attempted and after a failure to respond to bed rest the patient was treated in the immobilizing lung chamber for a period of four months at which time the cavity became no longer visible as seen in Fig 6. The sputum was negative. She was on bed rest for four months, now ambulatory.

Case 7 This case was previously reported in part at the conclusion of two and one-half months treatment.* He has continued to have negative sputum tests for two and a half years.

*Barach, A. L. "Continuous Immobilization of the Lungs by Residence in the Equalizing Pressure Chamber in the Treatment of Pulmonary Tuberculosis," *Dis. Chest*, 12 3, Nov-Dec, 1946.

DISCUSSION

The patients who have been treated under our supervision since the last report include 8 cases of pulmonary tuberculosis with cavitation. The treatment was given an adequate trial in 7 in whom a complete course of 4 to 5 months was maintained. Of these 7 cases, 6 showed a disappearance of cavity with negative sputum during or at the end of treatment. Since bed rest and pneumothorax were not effective in accomplishing closure of cavity in these cases, the consistent response to total lung rest produced by the equalizing pressure chamber indicates that the method has unique value in the therapy of pulmonary tuberculosis. It may be pointed out that immobilization of the lungs in the equalizing pressure chamber entails none of the possible complications of collapse therapy. There are no harmful side-effects of its use. Furthermore, no loss of respiratory function takes place since there is no disturbance of the normal anatomical structure of the healthy as well as the diseased portions of the lungs. Most of the cases (6 of 7) in this series were those in which cavities were present without the extensive bilateral lesions present in the group of cases previously reported.

Although the exact mechanism by which deflation of the cavity takes place during residence in the lung immobilizing chamber cannot be definitely stated, it seems justifiable to point out that the absence of expansion of the chest is of crucial importance. In those cases in which a check-valve is responsible for a readier inlet of air into the cavity during inspiration than an outlet of air during expiration, the prevention of recurrent cavity enlargement appears to be a reasonable explanation for improvement. Other factors may be involved for which there is at present insufficient evidence to discuss adequately. For example, the degree

of ventilation of the cavity as well as the tension of oxygen and carbon dioxide in the cavity under conditions of this type of ventilation cannot be determined. In some cases, the lumen to a tuberculous cavity may be so small as to result in lessened ventilation during chamber therapy than takes place when normal inspiratory enlargement of the chest expands the cavity as well as the bronchial tube leading to it. In this series obstruction to drainage did not occur in such a way as to lead to the development of a fluid level although this took place temporarily in one patient described in a previous series.

The effect of lung ventilation without lung movement on body rest is conspicuous, since these patients lie more quietly than they could otherwise with ordinary bed rest. The suggestion that patients might lie as quietly in a chamber of this sort without being exposed to the mechanism of equalizing pressure therapy has been shown to be impossible. Patients who lie in the chamber without lung rest mechanism being activated show the same movement from side to side as they do at bed rest. The complete form of body and lung rest obtained in the lung immobilizing chamber has an added value in that the total oxygen consumption is (presumably) markedly decreased. It may be emphasized that this form of body rest is not possible in the presence of voluntary respiration, since prolonged observation of patients who attempt rigid body rest reveals unmistakably that the degree of movement of the voluntary musculature is far in excess of patients in the equalizing pressure chamber during treatment.

The special character of the pulmonary, bodily and mental rest that takes place during residence in the chamber manifested by the lowering of the temperature, between 0.5 to 1° F, that is generally manifested even in patients without fever. In addition, the drop in pulse rate from 7 to 20 beats per minute suggests a lowering of the total oxygen consumption. In one patient who was very carefully observed the temperature range from 8 a.m. to 8 p.m. before treatment was from 97.6 to 99° F by mouth and at the end of three weeks ranged from 96.4 to 97.8° F. The blood pressure at the end of one hour of residence in the chamber is generally lowered from 15 to 20 mm Hg in the systolic phase and from 5 to 10 mm in the diastolic phase.

The electrocardiogram also shows a uniform elevation of the T wave in leads 1, 2 and 4, this is present both in the cases that have a marked as well as those that have a small decrease in pulse rate. The increase in height of the T wave, between 0.5 and 2 mm persists throughout the period of residence in the chamber and disappears gradually during a period of one-half hour after removal from the chamber. The average elevation of

T1 and T2 in 40 tests on 5 patients was 0.8 mm. The mechanism of elevation of the T wave will be commented upon when these data are presented in full. Whether an increase in oxygen tension of cardiac muscle takes place as a consequence of a maintained normal arterial oxygen saturation and a diminution in oxygen consumption of cardiac tissue is a matter of speculation. It would seem likely that the total cardiac output was decreased, along with the total oxygen consumption.

The absence of recurrent inspiratory negative chest pressures, ordinarily useful in aspirating blood into the right heart, does not appear to have an embarrassing effect on the circulation, perhaps the total blood flow is maintained at a higher level of intra-auricular pressure. In any event, this form of lung and body rest, accompanied by mental relaxation, is accompanied by alterations of physiologic equilibria, the precise study of which may reveal findings of considerable interest.

SUMMARY

The mechanism by which rest of both lungs is obtained without collapse therapy in subjects with pulmonary tuberculosis is described.

The clinical results of seven patients with cavitary pulmonary tuberculosis treated with immobilizing lung chamber therapy are reported.

In 6 of 7 completed cases, disappearance of cavity by x-ray examination and the development of negative sputum took place in a period of 4 to 5 months' treatment.

Immobilization of both lungs provides a therapeutic method of treatment of pulmonary tuberculous cavities that is free from the risk of the harmful side-effects of collapse therapy. The *absence* of respiratory enlargement of the lungs, which expand the tuberculous cavity in normal respiration, may be in part the mechanism of the gradual deflation of pulmonary cavities in patients treated in the immobilizing lung chamber. This mechanism would be particularly applicable in cavities with a small bronchial passageway in which a check-valve mechanism was previously operative.

This method of treatment requires careful supervision during the first week or ten days of the learning period. Thereafter, the properly trained patient generally maintains continuous arrest of lung movement without conscious effort.

RESUMEN

Se describe el mecanismo mediante el cual se obtiene el descanso de ambos pulmones en tuberculosos pulmonares sin emplear la colapsoterapia.

Se describen los resultados clínicos obtenidos en siete tuberculosos pulmonares con cavernas, tratados en cámaras de inmovilización del pulmón

En 6 de los 7 casos terminados desapareció la caverna en la radiografía y se volvió negativo el esputo en un período de tratamiento de 4 a 5 meses

La inmovilización de ambos pulmones proporciona un método para el tratamiento de cavernas pulmonares tuberculosas exento del riesgo de los efectos secundarios perjudiciales de la colapso-terapia. La *ausencia* de expansión respiratoria de los pulmones, que agranda la caverna tuberculosa durante la respiración normal, puede ser parte del mecanismo por el cual se desinflan gradualmente las cavernas pulmonares en pacientes tratados en la cámara de inmovilización del pulmón. Este mecanismo sería aplicable particularmente a cavernas con un pasadizo bronquial pequeño, en las que previamente existía un mecanismo de válvula de retención.

Este tratamiento requiere cuidadosa vigilancia durante los primeros siete o diez días del período de aprendizaje. Después de eso el paciente propiamente adiestrado generalmente mantiene la continua suspensión del movimiento pulmonar sin esfuerzo consciente.

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D I S C U S S I O N

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Physiologically the principle of Dr Barach's treatment is correct. He devised a lung equalizing machine which "breathes" for the patient, who remains still without expansion or re-expansion of the lungs. At the Nettie Bowne Hospital in Poughkeepsie, New York, we have two chambers and I would like to present the case studies of two patients. While in the chamber the patient is perfectly contented, happy and relaxed and takes the long, and what appears to be arduous task of lying still for a stretch of ten hours cheerfully.

Mrs. A. T., 32 years old, was admitted to our sanatorium in January 1945 with the diagnosis of far advanced pulmonary tuberculosis involving right upper lobe with giant cavity and slight scattered infiltration throughout the left upper lobe. She had cough, positive sputum and occasional elevation of temperature. On absolute bed rest she gained in weight and strength, her temperature became normal, other symptoms lessened and she was allowed limited privileges up and about her room. However, in the summer of 1945 there was spreading of disease in both lungs. On absolute bed rest her clinical picture again improved. Surgery for the right upper lobe was considered but she refused it. Improvement continued until March 1946 when the disease again spread, especially in the right upper lobe. Her temperature increased and she developed tuberculous laryngitis in May 1946. She continued to lose ground. Her sedimentation rate was high and cough and expectoration increased with continued positive sputum. She was placed in the chamber in August 1946 and in four weeks the symptoms markedly diminished. After a total of 20 weeks of continuous chamber treatment, the cavity in the right upper lobe remained unchanged, and there was no evidence of activity in the left lung. The previously recommended surgery was performed and at the present time she is in good condition. This case shows the value of the treatment especially in regard to clearing the disease in the left lung so that she was able to undergo thoracoplasty on the right side.

Mrs. M. T., 44, gave the history of having had tuberculosis diagnosed in September 1945, but according to her statement she unquestionably had the disease long before that time. When she was admitted to our institution in January 1946, she had far advanced bilateral pulmonary tuberculosis with a cavity (3" x 2" in diameter) in the 1st and 2nd interspaces on the left side. Absolute bed rest was instituted but no definite improvement occurred until November 1946 when some symptoms diminished, but the sputum was still positive. The cavity was somewhat smaller but there was increase of the process in the left central lung field and the lesion in the right upper lobe was more pronounced. Later the cavity appeared somewhat smaller than on previous observation. The right upper lobe showed some honey-combing. Her temperature again became elevated to 101 with a corresponding pulse of 104. It was

then decided that she should be given chamber treatment. After five weeks of this treatment only a small remainder of cavity in left upper lung field was seen, but there was still infiltration throughout the left upper lung field. The right lung showed decrease of involvement. Her temperature became normal, cough was practically gone and expectoration ceased. The sputum was negative, but the sedimentation rate was still 32 mm (Cutler). This patient stayed in the chamber until June 1, having a total of 985 hours of treatment. At this time she had no symptom or complaint. The sedimentation rate was normal and her sputum was negative. Gastric lavage was done and reported negative on direct smear and culture. Guinea pig inoculation was done but to-date no report has been received. In the left lung the cavity could not be visualized. Some residual infiltration was still present and perhaps some honey combing. In the right lung the lesion in the 1st and 2nd interspace was practically gone and in the 3rd interspace markedly decreased. It was decided that to achieve further recovery, the patient should have another ten weeks of treatment, but she failed to comply. This case represents remarkable improvement of general physical condition as well as x-ray changes in twenty weeks and in comparison with the previous 16 months of bed rest, the gain was evident.

Only the future will tell the final results. We strongly believe in the validity of this treatment and wonder what would happen to cavities of short duration with this type of treatment. The two cases here cited had far advanced, hopeless disease.

It is a pleasure and an honor to discuss the paper of such a distinguished scientist as Dr. Barach and before a gathering such as we have here today.

D I S C U S S I O N

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In pulmonary tuberculosis rest is the fundamental basis of all treatment. "Physical and mental rest" are the routine instructions of all phthisiologists to their patients. Collapse therapy measures are primarily devised to promote additional local rest to the lung. Recently Dr. Barach perfected his differential pressure lung immobilizer which we have been using for about eleven months, at the Alexian Brothers Hospital, Chicago, Illinois.

It is indeed a privilege to discuss Dr. Barach's paper on his more recent results with the use of his chamber. Dr. Barach has supplied for the tuberculous patient an additional step in our efforts for his recovery. It is obvious that with the large amount of elastic tissue in the lung, it will have a tendency to contract when it is immobilized. It is for this reason that cavities close

also with the use of practically all forms of collapse therapy. In our use of the chamber we have adopted the principle of giving assistance to patients in whom the accepted methods of therapy are either contraindicated or have been of no value. We have used the lung immobilizer as a preoperative and postoperative measure. Preoperatively, pulmonary rest by immobilization enhances the chances for recovery and reduces morbidity to a minimum. Postoperatively, especially after thoracoplasty, the chest wall is protected against paradoxical mobility and a better result may be obtained.

We have used the immobilizer on thirteen patients, two of whom had to be discontinued, one because of claustrophobia and the other because of severe pain in the ears due to occluded eustachian tubes. In the remaining eleven patients we invariably noticed improvement, with conversion of the sputum in nine patients. Dr. Barach mentioned the tendency of the patient to relax, both in the chamber and for an hour or two after leaving the chamber. We have noticed the same reaction in our patients and often we were requested by them for longer periods in the chamber than eight hours.

The possibilities for the use of the immobilizer are many and varied. At present only tuberculous cases are being treated. I anticipate its use in arterial hypertension, cardiac disease and perhaps even possibly in cases of toxic goitres.

As more chambers are produced, this excellent method of treatment will become available to more and more persons who at present are doomed and who may have a chance to prolong their lives and become rehabilitated to a more useful and happy existence.

Pulmonary Heart Disease*

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Although pulmonary heart disease, or cor pulmonale, is generally conceded to result from pulmonary arterial hypertension, the latter more frequently produces cardiac damage when the term cor pulmonale is not used. Figure 1 gives a classification of the conditions producing such hypertension. Most common are the causes falling under Ib, Figure 1, in which obstruction is transmitted backward from structures beyond the pulmonary tissues. Thus, all conditions which affect and cause failure of the left ventricle, such as systemic arterial hypertension and coronary sclerosis as well as obstructive lesions in the left heart, mitral stenosis, for example, are etiologic factors. Shunts, II in Figure 1, connecting the pulmonary artery and aorta, act in a similar way when they are of sufficient magnitude physiologically to produce significant change in pulmonary pressure. Patent ductus arteriosus is an example of such a chronic condition, and aortic aneurysm rupturing into the pulmonary artery an example of an acutely developing one.

Cor pulmonale, as the term is usually used, is concerned only with the recognition of those conditions falling under Ia in Figure 1, in which changes in the pulmonary structures themselves are responsible for the pulmonary hypertension and, in turn, for damage to the right heart. Of these only those which are chronic in type will be considered in this report. Acute damage to the pulmonary circulation of sufficient magnitude to produce acute right sided cardiac strain, as occurs in pulmonary embolism, will not be discussed.

Chronic cor pulmonale may be produced by a variety of changes in the structures of the chest. These have been classified by Spain and Handler¹ into three large groups, anatomic alterations of the thoracic cage, of the pulmonary vascular system, and of the pulmonary parenchyma. Those arising as a result of change in the lung constitute the largest and most important group.

In the past five years in the records of the Charity Hospital there have been 15 recorded instances of chronic cor pulmonale.

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**Department of Tropical Medicine and Public Health, School of Medicine, The Tulane University of Louisiana and The Charity Hospital of Louisiana at New Orleans.

The etiologic factors underlying this group were related to the presence of emphysema. In 8 instances bronchial asthma was present, and in 3 emphysema not related to a gross pulmonary diagnosis. In 2 tuberculosis, in 1 bronchiectasis, and in 1 schistosomiasis were present. If these are added to the larger groups of Scott and Garvin² and Spain and Handler¹ and the etiologic factors for the entire group listed, they will appear as shown in Figure 2. Perusal of this list will indicate the types of pulmonary disease usually responsible for chronic cor pulmonale. All of the conditions reported as causing chronic cor pulmonale are not included for some of the rarer ones, such as compression of the pulmonary artery by aortic aneurysm³ and multiple cysts of the lung, did not occur in the group.

The mechanism whereby these conditions produce changes in the right heart will not be detailed here. Others¹ have recently discussed these aspects of the problem and the reader is referred to that report. Diffuse obstructive emphysema, either primary or secondary to such diseases as pulmonary tuberculosis or silicosis, is considered as the significant underlying pulmonary factor in the vast majority of the cases. This condition apparently produces a changed pressure relation within the alveolus and in this manner there results an increased resistance to the flow of

FIGURE 1
PULMONARY HYPERTENSION

- I Obstruction to pulmonary blood flow
 - a *In the pulmonary structures themselves*
 - b Transmitted backward from structures beyond the pulmonary tissues
 - II Augmentation of pulmonary pressure through shunts
-

FIGURE 2
ETIOLOGIC FACTORS IN 123 COLLECTED CASES
OF CHRONIC COR PULMONALE

Emphysema	75
Bronchial Asthma	14
Tuberculosis	9
Silicosis	8
Bronchiectasis	7
Silicotuberculosis	5
Pulmonary fibrosis	1
Kyphoscoliosis	1
Pulmonary arteriosclerosis	1
Organized pulmonary thrombi	1
Schistosomiasis	1

blood to the lungs. Such associated factors as anatomic obliteration of the pulmonary vascular bed, fibrosis of the lung, compensatory polycythemia and overfilling of the heart are considered as secondary aggravating factors of varying significance.¹

A review of the clinical manifestations of chronic cor pulmonale in our group disclosed that 13 patients presented themselves with the picture of right ventricular failure. In 2, or 13.3 per cent, of the patients, the outstanding clinical manifestations were those of the primary pulmonary disease. Brill⁴ in 1939 recognized the grouping of patients into these two classes, with what he called the early pulmonary phase and a later cardiac phase. Until right sided heart failure with distended neck veins, hepatomegaly, prolonged circulation time and dependent edema appear, the symptoms have been essentially those of the pulmonary disease, often with dyspnea, cough, and hemoptysis, findings which do occur with affections of the left side of the heart and which have been present in many of these patients for years. A change in the symptoms in these patients is an important evidence of oncoming cardiac failure. The dyspnea may be worse, the patient can no longer lie down, cyanosis, if not present, appears, and, if present, is accentuated. When the patient was examined, the pulmonary state, including emphysema, was usually present and the evaluation of the heart was difficult. This difficulty rested chiefly in the pulmonary changes which interfere with percussion of the cardiac borders. Heart tones, too, were frequently distant and various systolic murmurs, difficult to interpret clinically, were present. However, a number of findings were often present which frequently were disregarded. These will be mentioned below. When the signs of right sided heart failure, distended veins, hepatomegaly, and edema, occurred, these were, of course, evident.

It is clear that until frank evidences of heart failure appear, the possibility of a clinical cardiac state being present is frequently not entertained. This was true in our group and in one large series of 60 patients,¹ in not one case was the diagnosis of cor pulmonale established or entertained prior to the onset of the symptoms and signs of heart failure. The frequency of cor pulmonale in the necropsied series of Scott and Garvin² was 50 cases in 6,548 necropsies, including 890 involved cases of cardiac disease. This represents 6.3 per cent of all cases of cardiac disease necropsied. In our hospital, the clinical recognition of cor pulmonale represents less than one per cent of the cases of heart disease seen, indicating that in all probability many of the instances of cor pulmonale entering the institution are not diagnosed. Usually, when a diagnosis is made, in 86.7 per cent of our patients, the patient is already in heart failure, and treatment, which is

most important in the stage before heart failure develops, has been too long delayed

When heart failure does appear, especially because of the age distribution of the patients, which in our group was greatest from 40 to 49 years, arteriosclerotic heart disease is a frequent diagnosis. This was true in our series and in that of Spain and Handler,¹ chiefly because in heart failure, in this age group, when the common causes for heart disease other than arteriosclerosis are eliminated, that diagnosis is often given on an exclusion basis. A review of the records from our patients in whom the diagnosis was finally made indicates that the delay in recognition of cor pulmonale is due, in large part, to neglect of a number of diagnostic aids. For example, the evaluation is delayed of many multiple small findings on history and physical examination, any one of which alone is difficult to interpret, but which, taken as a group, make a suggestive and, at times, a formidable story. Then, with such a story, the special procedures of electrocardiography, fluoroscopy, and the determination of venous pressure and circulation time can be utilized. Even with these aids, it may take, as several of our records clearly show, observation for months or several years to indicate definitely the presence of cardiac damage. To increase the frequency of such diagnoses, it is proposed that all patients with chronic pulmonary disease, especially when associated with emphysema, be examined carefully by these methods.

In physical examination, special thought must be given to the evidences of right ventricular strain. This includes, aside from the obvious evidences of edema, hepatomegaly, and distended neck veins, particular attention to early findings, accentuation of P_2 , the pulmonic diastolic impact, observation of the precordium for a retraction wave, which often occurs normally over the right ventricle, but becomes more marked in right ventricular hypertrophy. It appears as a wave progressing across the precordium toward the apex and is often accompanied by a distinct systolic retraction in the epigastrium. This latter finding also occurs with a ptotic heart, in pleural effusion, and in anemias. All of these physical findings, each by itself of no great significance and frequently capable of being interpreted and explained on other grounds, when occurring together or in multiples, are of extreme importance for they then make the possibility of right ventricular disease as their cause more likely and should lead to further investigation of the patient by the methods about to be discussed. In 10 of our 15 patients, the diagnosis was first suggested on these grounds which led to electrocardiographic, radiologic, and hemodynamic studies.

Electrocardiographic studies, including chest leads, were done

in 12 of our 15 patients In 2 instances the findings gave the first suggestions of the presence of cor pulmonale This figure would have been higher had it not been for the alertness of the staff in establishing the physical evidences of right ventricular strain as described above In 6 instances definite right axis deviation occurred, in 2 it was slight In 3 patients, low complexes were present and in one nothing unusual at all The presence and degree of right axis deviation, the determination of the axis index, the study of a series of chest leads taken from right to left across the precordium and the use of special chest leads are the most important points for consideration The method of examination, particularly when serial tracings are available, may be of great help This was true in 2 instances in our group

Radiologic examination is practicable both with fluoroscopic and roentgenographic techniques These methods, especially when the oblique views are used along with the PA views, will give much information concerning the right ventricle In the PA view prominence of the region of the pulmonary conus may be seen at times when all other evidences are negative In general, in our group, in which PA roentgenograms were taken, in 11 of the 15 patients prominence of the pulmonary conus was not sufficiently remarkable to give great help However, when seen, even though only suggestive, it should lead to adequate oblique views or the use of fluoroscopy In both oblique views encroachment of the heart shadow beyond the limits of normal may, at times, be seen long before other evidences of cardiac involvement occur Fluoroscopy lends itself well to study of the oblique positions and we have found it most helpful in establishing the presence of right ventricular involvement In 2 of our patients it was the only evidence present

Hemodynamic studies by the venous pressure and circulation time determinations are simple clinical procedures In the presence of emphysema the former may be difficult to interpret The circulation time, especially in an alert patient, is much more frequently helpful Of course, early in these pictures, at a time when diagnosis is most important, both these findings are normal We have found the circulation time more reliable than the venous pressure studies in emphysema In 2 cases, for example, with venous pressures of 110 and 130 mm of water, values not absolutely abnormal, the circulation times, arm-to-tongue, were 30 seconds and 23 seconds, respectively

RESUMEN

El análisis de los protocolos de 15 pacientes con cor pulmonale crónico indica que (1) la presencia de enfermedad pulmonar

crónica es una indicación para que se lleve a cabo una investigación completa del corazón del paciente a fin de verificar la posible presencia de cor pulmonale, (2) las manifestaciones clínicas sobresalientes desde el punto de vista de síntomas y signos físicos antes de que aparezca la insuficiencia cardíaca franca, son índices poco valiosos de la presencia de esta enfermedad, pero signos tempranos en la historia y en el examen físico de daño al ventrículo derecho, a menudo descuidados debido a su carácter menor, son indicaciones especialmente útiles en la investigación adicional del paciente, (3) en estas circunstancias es necesario llevar a cabo una investigación especial del corazón con estudios adecuados electrocardiográficos, roentgenoscópicos y hemodinámicos a fin de establecer el diagnóstico de cor pulmonale crónico con alguna exactitud en la etapa anterior a la aparición de insuficiencia del corazón derecho, la etapa más importante en el tratamiento

SUMMARY

Analysis of the records of 15 patients with chronic cor pulmonale indicates that (1) the presence of chronic pulmonary disease is an indication to carry out a complete investigation of the patient's heart to establish the possible presence of cor pulmonale, (2) the outstanding clinical manifestations from the standpoint of symptoms and physical findings before frank heart failure appears are a poor index of the presence of this disease, but early historical and physical evidences of right ventricular strain, often neglected because of their minor character, are particularly helpful indicators for further investigation of the patient, (3) the addition of special investigation of the heart under the above circumstances with adequate electrocardiographic, fluoroscopic, and hemodynamic studies is necessary to establish the diagnosis of chronic cor pulmonale with any degree of accuracy in the stage before right sided heart failure appears, the stage most important in treatment

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The Role of Bronchoscopy in Clinical Medicine and Surgery*

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Due to the demands of the rapid progress of medical science during the past decade, bronchoscopy has come to play an important role in the diagnosis and treatment of pulmonary diseases. To quote that famous teacher of bronchoscopy, Chevalier Jackson: "Look and see is the order of the day. In every accessible region of the body, the aid of direct vision is called upon to contribute to diagnosis and treatment."¹

In the diagnosis of thoracic diseases, the internist, by means of external inspection, percussion, and auscultation, usually obtains sufficient information to establish a tentative diagnosis. His findings may be further corroborated by the roentgenologist, who by means of fluoroscopic and roentgenographic examinations has an opportunity, as it were, to look through the chest. But it remains for the bronchoscopist, by means of direct visual inspection, to look inside the bronchial tree and observe the underlying pathologic condition. It becomes evident, then, that when there exists such a close association between the internist, the roentgenologist, and the bronchoscopist, the diagnosis of pulmonary conditions is greatly facilitated.

Aside from the removal of aspirated foreign bodies in lungs, for which no procedure other than bronchoscopy is worthy of a moment's consideration, the profession at large has not realized that the greatest value of the bronchoscope is in diagnosis. A recent statistical survey of the patients admitted to several of the large bronchoscopic clinics in this country revealed that only 2 per cent of the admissions were for the removal of foreign bodies. The late Dr. Howard Lillenthal, one of the great teachers of thoracic disease, has on many occasions stated: "The scope of bronchoscopy has rapidly widened from the mere extraction of foreign bodies to the diagnosis and treatment of many pulmonary lesions, such as abscess of the lung, tumor of the lung, bronchial narrowing, bronchial ulceration, postoperative atelec-

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Case 4 Woman, age 26 years, who had a history of tuberculosis for two years. Pneumothorax was attempted on the left without success, but the patient recovered under conservative therapy and was apparently well for one year and nine months when the disease in the left lung reactivated and revealed a cavity with positive sputum. She was admitted to the House of Rest two months later where a cavity 3 cm in diameter was found in the second interspace on the left with positive sputum. The patient was afebrile. Since the cavity did not respond to bed rest she was begun on immobilizing lung treatment six months later. She became immobilized in one week. The sputum became negative two weeks after treatment was started and has continued to be negative. At the end of five months the cavity is no longer visible. A small shadow about 4 mm in extent was seen in the x-ray at the site of the original cavity. She was on bed rest for four months, now ambulatory.

Case 5 Woman, age 26 years, whose pulmonary tuberculosis was diagnosed following a hemoptysis five years prior to admission. At that time she was found to have pulmonary tuberculosis with bilateral cavitation. Pneumothorax was induced on the left and six months later on the right. The bilateral cavitation fluctuated markedly in size and the patient's sputum continued positive for a year when it became negative for one year, after which time the cavity in the left lung reopened. The pneumothorax on the left, and a year later, because the cavity in the right reopened, the right pneumothorax were abandoned. At the time of treatment she had a 6 cm cavity in the right mid-lung at the level of the third inter-costal space and a 3 cm cavity in the second left costal interspace. The sputum was positive. Although considerable reduction in respiratory motion was obtained complete immobilization was never secured because of pulmonary emphysema. She was, however, given chamber treatment. The cavity in the right lung finally reached one-quarter of its previous size, but the cavity in the left lung which was at first stationary began to increase. The chamber treatment was finally abandoned at the end of six months.

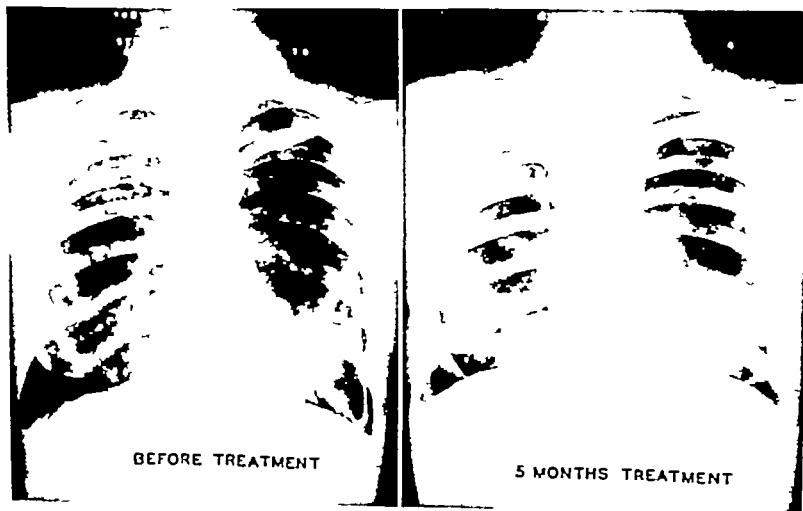


FIGURE 4 X-ray films before and after 5 months treatment

The accompanying x-ray films (Figs 4 and 5) illustrate the closure of cavity as a result of immobilizing lung treatment in Cases 3 and 4

Case 6 Woman, age 52 years The diagnosis of pulmonary tuberculosis was made six years ago Pneumothorax was induced on the left at that time and was successfully maintained for two years when it was optionally abandoned About three years later the disease in the left lung



FIGURE 5 X-ray films before and after 4½ months treatment

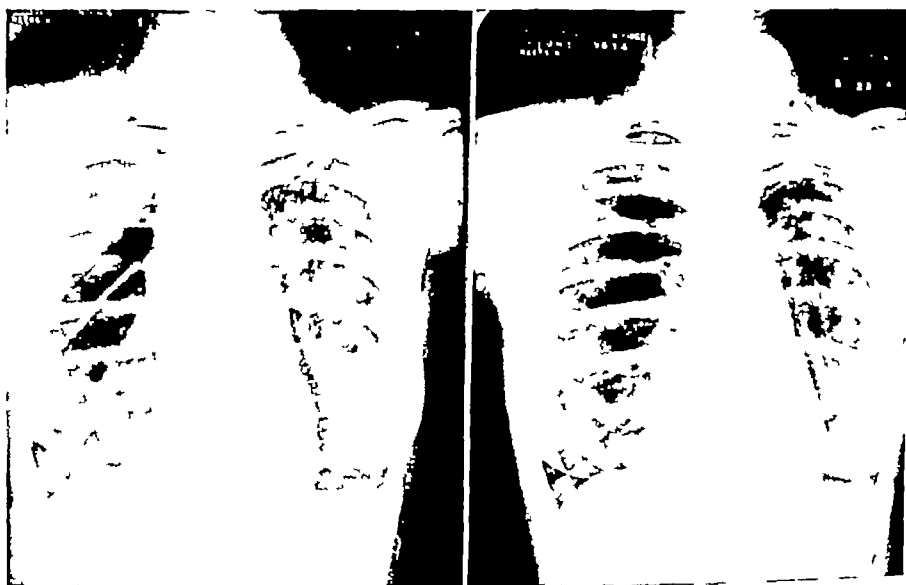


FIGURE 6 X-ray films before and after 4 months treatment and 2 months bed rest

became re-activated with evidence of a cavity in the third interspace and the sputum was positive. She was admitted to the House of Rest where it was found that a small scattered nodulation extending from the first to the third intercostal space was present on the left with a 4 cm cavity over the second rib. The patient was afebrile.

Pneumothorax was unsuccessfully attempted and after a failure to respond to bed rest the patient was treated in the immobilizing lung chamber for a period of four months at which time the cavity became no longer visible as seen in Fig 6. The sputum was negative. She was on bed rest for four months, now ambulatory.

Case 7 This case was previously reported in part at the conclusion of two and one-half months treatment.* He has continued to have negative sputum tests for two and a half years.

*Barach, A. L. "Continuous Immobilization of the Lungs by Residence in the Equalizing Pressure Chamber in the Treatment of Pulmonary Tuberculosis," *Dis Chest*, 12 3, Nov-Dec, 1946.

DISCUSSION

The patients who have been treated under our supervision since the last report include 8 cases of pulmonary tuberculosis with cavitation. The treatment was given an adequate trial in 7 in whom a complete course of 4 to 5 months was maintained. Of these 7 cases, 6 showed a disappearance of cavity with negative sputum during or at the end of treatment. Since bed rest and pneumothorax were not effective in accomplishing closure of cavity in these cases, the consistent response to total lung rest produced by the equalizing pressure chamber indicates that the method has unique value in the therapy of pulmonary tuberculosis. It may be pointed out that immobilization of the lungs in the equalizing pressure chamber entails none of the possible complications of collapse therapy. There are no harmful side-effects of its use. Furthermore, no loss of respiratory function takes place since there is no disturbance of the normal anatomical structure of the healthy as well as the diseased portions of the lungs. Most of the cases (6 of 7) in this series were those in which cavities were present without the extensive bilateral lesions present in the group of cases previously reported.

Although the exact mechanism by which deflation of the cavity takes place during residence in the lung immobilizing chamber cannot be definitely stated, it seems justifiable to point out that the absence of expansion of the chest is of crucial importance. In those cases in which a check-valve is responsible for a readier inlet of air into the cavity during inspiration than an outlet of air during expiration, the prevention of recurrent cavity enlargement appears to be a reasonable explanation for improvement. Other factors may be involved for which there is at present insufficient evidence to discuss adequately. For example, the degree

of ventilation of the cavity as well as the tension of oxygen and carbon dioxide in the cavity under conditions of this type of ventilation cannot be determined. In some cases, the lumen to a tuberculous cavity may be so small as to result in lessened ventilation during chamber therapy than takes place when normal inspiratory enlargement of the chest expands the cavity as well as the bronchial tube leading to it. In this series obstruction to drainage did not occur in such a way as to lead to the development of a fluid level although this took place temporarily in one patient described in a previous series.

The effect of lung ventilation without lung movement on body rest is conspicuous, since these patients lie more quietly than they could otherwise with ordinary bed rest. The suggestion that patients might lie as quietly in a chamber of this sort without being exposed to the mechanism of equalizing pressure therapy has been shown to be impossible. Patients who lie in the chamber without lung rest mechanism being activated show the same movement from side to side as they do at bed rest. The complete form of body and lung rest obtained in the lung immobilizing chamber has an added value in that the total oxygen consumption is (presumably) markedly decreased. It may be emphasized that this form of body rest is not possible in the presence of voluntary respiration, since prolonged observation of patients who attempt rigid body rest reveals unmistakably that the degree of movement of the voluntary musculature is far in excess of patients in the equalizing pressure chamber during treatment.

The special character of the pulmonary, bodily and mental rest that takes place during residence in the chamber manifested by the lowering of the temperature, between 0.5 to 1° F, that is generally manifested even in patients without fever. In addition, the drop in pulse rate from 7 to 20 beats per minute suggests a lowering of the total oxygen consumption. In one patient who was very carefully observed the temperature range from 8 a.m. to 8 p.m. before treatment was from 97.6 to 99° F by mouth and at the end of three weeks ranged from 96.4 to 97.8° F. The blood pressure at the end of one hour of residence in the chamber is generally lowered from 15 to 20 mm Hg in the systolic phase and from 5 to 10 mm in the diastolic phase.

The electrocardiogram also shows a uniform elevation of the T wave in leads 1, 2 and 4, this is present both in the cases that have a marked as well as those that have a small decrease in pulse rate. The increase in height of the T wave, between 0.5 and 2 mm persists throughout the period of residence in the chamber and disappears gradually during a period of one-half hour after removal from the chamber. The average elevation of

T1 and T2 in 40 tests on 5 patients was 0.8 mm. The mechanism of elevation of the T wave will be commented upon when these data are presented in full. Whether an increase in oxygen tension of cardiac muscle takes place as a consequence of a maintained normal arterial oxygen saturation and a diminution in oxygen consumption of cardiac tissue is a matter of speculation. It would seem likely that the total cardiac output was decreased, along with the total oxygen consumption.

The absence of recurrent inspiratory negative chest pressures, ordinarily useful in aspirating blood into the right heart, does not appear to have an embarrassing effect on the circulation, perhaps the total blood flow is maintained at a higher level of intra-auricular pressure. In any event, this form of lung and body rest, accompanied by mental relaxation, is accompanied by alterations of physiologic equilibria, the precise study of which may reveal findings of considerable interest.

SUMMARY

The mechanism by which rest of both lungs is obtained without collapse therapy in subjects with pulmonary tuberculosis is described.

The clinical results of seven patients with cavitary pulmonary tuberculosis treated with immobilizing lung chamber therapy are reported.

In 6 of 7 completed cases, disappearance of cavity by x-ray examination and the development of negative sputum took place in a period of 4 to 5 months' treatment.

Immobilization of both lungs provides a therapeutic method of treatment of pulmonary tuberculous cavities that is free from the risk of the harmful side-effects of collapse therapy. The *absence* of respiratory enlargement of the lungs, which expand the tuberculous cavity in normal respiration, may be in part the mechanism of the gradual deflation of pulmonary cavities in patients treated in the immobilizing lung chamber. This mechanism would be particularly applicable in cavities with a small bronchial passageway in which a check-valve mechanism was previously operative.

This method of treatment requires careful supervision during the first week or ten days of the learning period. Thereafter, the properly trained patient generally maintains continuous arrest of lung movement without conscious effort.

RESUMEN

Se describe el mecanismo mediante el cual se obtiene el descanso de ambos pulmones en tuberculosos pulmonares sin emplear la colapsoterapia.

Se describen los resultados clínicos obtenidos en siete tuberculosos pulmonares con cavernas, tratados en cámaras de inmovilización del pulmón

En 6 de los 7 casos terminados desapareció la caverna en la radiografía y se volvió negativo el esputo en un período de tratamiento de 4 a 5 meses

La inmovilización de ambos pulmones proporciona un método para el tratamiento de cavernas pulmonares tuberculosas exento del riesgo de los efectos secundarios perjudiciales de la colapso-terapia. La ausencia de expansión respiratoria de los pulmones, que agranda la caverna tuberculosa durante la respiración normal, puede ser parte del mecanismo por el cual se desinflan gradualmente las cavernas pulmonares en pacientes tratados en la cámara de inmovilización del pulmón. Este mecanismo sería aplicable particularmente a cavernas con un pasadizo bronquial pequeño, en las que previamente existía un mecanismo de válvula de retención.

Este tratamiento requiere cuidadosa vigilancia durante los primeros siete o diez días del período de aprendizaje. Después de eso el paciente propiamente adiestrado generalmente mantiene la continua suspensión del movimiento pulmonar sin esfuerzo consciente.

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D I S C U S S I O N

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Physiologically the principle of Dr Barach's treatment is correct. He devised a lung equalizing machine which "breathes" for the patient, who remains still without expansion or re-expansion of the lungs. At the Nettle Bowne Hospital in Poughkeepsie, New York, we have two chambers and I would like to present the case studies of two patients. While in the chamber the patient is perfectly contented, happy and relaxed and takes the long, and what appears to be arduous task of lying still for a stretch of ten hours cheerfully.

Mrs. A. T., 32 years old, was admitted to our sanatorium in January 1945 with the diagnosis of far advanced pulmonary tuberculosis, involving right upper lobe with giant cavity and slight scattered infiltration throughout the left upper lobe. She had cough, positive sputum and occasional elevation of temperature. On absolute bed rest she gained in weight and strength, her temperature became normal, other symptoms lessened and she was allowed limited privileges up and about her room. However, in the summer of 1945 there was spreading of disease in both lungs. On absolute bed rest her clinical picture again improved. Surgery for the right upper lobe was considered but she refused it. Improvement continued until March 1946 when the disease again spread, especially in the right upper lobe. Her temperature increased and she developed tuberculous laryngitis in May 1946. She continued to lose ground. Her sedimentation rate was high and cough and expectoration increased with continued positive sputum. She was placed in the chamber in August 1946 and in four weeks the symptoms markedly diminished. After a total of 20 weeks of continuous chamber treatment the cavity in the right upper lobe remained unchanged, and there was no evidence of activity in the left lung. The previously recommended surgery was performed and at the present time she is in good condition. This case shows the value of the treatment especially in regard to clearing the disease in the left lung so that she was able to undergo thoracoplasty on the right side.

Mrs. M. T., 44, gave the history of having had tuberculosis diagnosed in September 1945 but according to her statement she unquestionably had the disease long before that time. When she was admitted to our institution in January 1946, she had far advanced bilateral pulmonary tuberculosis with a cavity (3" x 2" in diameter) in the 1st and 2nd inter-spaces on the left side. Absolute bed rest was instituted but no definite improvement occurred until November 1946 when some symptoms diminished, but the sputum was still positive. The cavity was somewhat smaller but there was increase of the process in the left central lung field and the lesion in the right upper lobe was more pronounced. Later the cavity appeared somewhat smaller than on previous observation. The right upper lobe showed some honey-combing. Her temperature again became elevated to 101 with a corresponding pulse of 104. It was

then decided that she should be given chamber treatment. After five weeks of this treatment only a small remainder of cavity in left upper lung field was seen, but there was still infiltration throughout the left upper lung field. The right lung showed decrease of involvement. Her temperature became normal, cough was practically gone and expectoration ceased. The sputum was negative, but the sedimentation rate was still 32 mm (Cutler). This patient stayed in the chamber until June 1, having a total of 985 hours of treatment. At this time she had no symptom or complaint. The sedimentation rate was normal and her sputum was negative. Gastric lavage was done and reported negative on direct smear and culture. Guinea pig inoculation was done but to-date no report has been received. In the left lung the cavity could not be visualized. Some residual infiltration was still present and perhaps some honey combing. In the right lung the lesion in the 1st and 2nd interspace was practically gone and in the 3rd interspace markedly decreased. It was decided that to achieve further recovery, the patient should have another ten weeks of treatment, but she failed to comply. This case represents remarkable improvement of general physical condition as well as x-ray changes in twenty weeks and in comparison with the previous 16 months of bed rest, the gain was evident.

Only the future will tell the final results. We strongly believe in the validity of this treatment and wonder what would happen to cavities of short duration with this type of treatment. The two cases here cited had far advanced, hopeless disease.

It is a pleasure and an honor to discuss the paper of such a distinguished scientist as Dr. Barach and before a gathering such as we have here today.

D I S C U S S I O N

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In pulmonary tuberculosis rest is the fundamental basis of all treatment. "Physical and mental rest" are the routine instructions of all phthisiologists to their patients. Collapse therapy measures are primarily devised to promote additional local rest to the lung. Recently Dr. Barach perfected his differential pressure lung immobilizer which we have been using for about eleven months, at the Alexian Brothers Hospital, Chicago, Illinois.

It is indeed a privilege to discuss Dr. Barach's paper on his more recent results with the use of his chamber. Dr. Barach has supplied for the tuberculous patient an additional step in our efforts for his recovery. It is obvious that with the large amount of elastic tissue in the lung, it will have a tendency to contract when it is immobilized. It is for this reason that cavities close

also with the use of practically all forms of collapse therapy. In our use of the chamber we have adopted the principle of giving assistance to patients in whom the accepted methods of therapy are either contraindicated or have been of no value. We have used the lung immobilizer as a preoperative and postoperative measure. Preoperatively, pulmonary rest by immobilization enhances the chances for recovery and reduces morbidity to a minimum. Postoperatively, especially after thoracoplasty, the chest wall is protected against paradoxical mobility and a better result may be obtained.

We have used the immobilizer on thirteen patients, two of whom had to be discontinued, one because of claustrophobia and the other because of severe pain in the ears due to occluded eustachian tubes. In the remaining eleven patients we invariably noticed improvement, with conversion of the sputum in nine patients. Dr. Barach mentioned the tendency of the patient to relax, both in the chamber and for an hour or two after leaving the chamber. We have noticed the same reaction in our patients and often we were requested by them for longer periods in the chamber than eight hours.

The possibilities for the use of the immobilizer are many and varied. At present only tuberculous cases are being treated. I anticipate its use in arterial hypertension, cardiac disease and perhaps even possibly in cases of toxic goitres.

As more chambers are produced, this excellent method of treatment will become available to more and more persons who at present are doomed and who may have a chance to prolong their lives and become rehabilitated to a more useful and happy existence.

Pulmonary Heart Disease*

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Although pulmonary heart disease, or cor pulmonale, is generally conceded to result from pulmonary arterial hypertension, the latter more frequently produces cardiac damage when the term cor pulmonale is not used. Figure 1 gives a classification of the conditions producing such hypertension. Most common are the causes falling under Ib, Figure 1, in which obstruction is transmitted backward from structures beyond the pulmonary tissues. Thus, all conditions which affect and cause failure of the left ventricle, such as systemic arterial hypertension and coronary sclerosis as well as obstructive lesions in the left heart, mitral stenosis, for example, are etiologic factors. Shunts, II in Figure 1, connecting the pulmonary artery and aorta, act in a similar way when they are of sufficient magnitude physiologically to produce significant change in pulmonary pressure. Patent ductus arteriosus is an example of such a chronic condition, and aortic aneurysm rupturing into the pulmonary artery an example of an acutely developing one.

Cor pulmonale, as the term is usually used, is concerned only with the recognition of those conditions falling under Ia in Figure 1, in which changes in the pulmonary structures themselves are responsible for the pulmonary hypertension and, in turn, for damage to the right heart. Of these only those which are chronic in type will be considered in this report. Acute damage to the pulmonary circulation of sufficient magnitude to produce acute right sided cardiac strain, as occurs in pulmonary embolism, will not be discussed.

Chronic cor pulmonale may be produced by a variety of changes in the structures of the chest. These have been classified by Spain and Handler¹ into three large groups, anatomic alterations of the thoracic cage, of the pulmonary vascular system, and of the pulmonary parenchyma. Those arising as a result of change in the lung constitute the largest and most important group.

In the past five years in the records of the Charity Hospital there have been 15 recorded instances of chronic cor pulmonale.

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The etiologic factors underlying this group were related to the presence of emphysema. In 8 instances bronchial asthma was present, and in 3 emphysema not related to a gross pulmonary diagnosis. In 2 tuberculosis, in 1 bronchiectasis, and in 1 schistosomiasis were present. If these are added to the larger groups of Scott and Garvin² and Spain and Handler¹ and the etiologic factors for the entire group listed, they will appear as shown in Figure 2. Perusal of this list will indicate the types of pulmonary disease usually responsible for chronic cor pulmonale. All of the conditions reported as causing chronic cor pulmonale are not included for some of the rarer ones, such as compression of the pulmonary artery by aortic aneurysm³ and multiple cysts of the lung, did not occur in the group.

The mechanism whereby these conditions produce changes in the right heart will not be detailed here. Others¹ have recently discussed these aspects of the problem and the reader is referred to that report. Diffuse obstructive emphysema, either primary or secondary to such diseases as pulmonary tuberculosis or silicosis, is considered as the significant underlying pulmonary factor in the vast majority of the cases. This condition apparently produces a changed pressure relation within the alveolus and in this manner there results an increased resistance to the flow of

FIGURE 1 PULMONARY HYPERTENSION

- I Obstruction to pulmonary blood flow
 - a *In the pulmonary structures themselves*
 - b Transmitted backward from structures beyond the pulmonary tissues
 - II Augmentation of pulmonary pressure through shunts
-

FIGURE 2 ETIOLOGIC FACTORS IN 123 COLLECTED CASES OF CHRONIC COR PULMONALE

Emphysema	75
Bronchial Asthma	14
Tuberculosis	9
Silicosis	8
Bronchiectasis	7
Silicotuberculosis	5
Pulmonary fibrosis	1
Kyphoscoliosis	1
Pulmonary arteriosclerosis	1
Organized pulmonary thrombi	1
Schistosomiasis	1

blood to the lungs. Such associated factors as anatomic obliteration of the pulmonary vascular bed, fibrosis of the lung, compensatory polycythemia and overfilling of the heart are considered as secondary aggravating factors of varying significance.¹

A review of the clinical manifestations of chronic cor pulmonale in our group disclosed that 13 patients presented themselves with the picture of right ventricular failure. In 2, or 13.3 per cent, of the patients, the outstanding clinical manifestations were those of the primary pulmonary disease. Brill⁴ in 1939 recognized the grouping of patients into these two classes, with what he called the early pulmonary phase and a later cardiac phase. Until right sided heart failure with distended neck veins, hepatomegaly, prolonged circulation time and dependent edema appear, the symptoms have been essentially those of the pulmonary disease, often with dyspnea, cough, and hemoptysis, findings which do occur with affections of the left side of the heart and which have been present in many of these patients for years. A change in the symptoms in these patients is an important evidence of oncoming cardiac failure. The dyspnea may be worse, the patient can no longer lie down, cyanosis, if not present, appears, and, if present, is accentuated. When the patient was examined, the pulmonary state, including emphysema, was usually present and the evaluation of the heart was difficult. This difficulty rested chiefly in the pulmonary changes which interfere with percussion of the cardiac borders. Heart tones, too, were frequently distant and various systolic murmurs, difficult to interpret clinically, were present. However, a number of findings were often present which frequently were disregarded. These will be mentioned below. When the signs of right sided heart failure, distended veins, hepatomegaly, and edema, occurred, these were, of course, evident.

It is clear that until frank evidences of heart failure appear, the possibility of a clinical cardiac state being present is frequently not entertained. This was true in our group and in one large series of 60 patients,¹ in not one case was the diagnosis of cor pulmonale established or entertained prior to the onset of the symptoms and signs of heart failure. The frequency of cor pulmonale in the necropsied series of Scott and Garvin² was 50 cases in 6,548 necropsies, including 890 involved cases of cardiac disease. This represents 6.3 per cent of all cases of cardiac disease necropsied. In our hospital, the clinical recognition of cor pulmonale represents less than one per cent of the cases of heart disease seen, indicating that in all probability many of the instances of cor pulmonale entering the institution are not diagnosed. Usually, when a diagnosis is made, in 86.7 per cent of our patients, the patient is already in heart failure, and treatment, which is

most important in the stage before heart failure develops, has been too long delayed

When heart failure does appear, especially because of the age distribution of the patients, which in our group was greatest from 40 to 49 years, arteriosclerotic heart disease is a frequent diagnosis. This was true in our series and in that of Spain and Handler,¹ chiefly because in heart failure, in this age group, when the common causes for heart disease other than arteriosclerosis are eliminated, that diagnosis is often given on an exclusion basis. A review of the records from our patients in whom the diagnosis was finally made indicates that the delay in recognition of cor pulmonale is due, in large part, to neglect of a number of diagnostic aids. For example, the evaluation is delayed of many multiple small findings on history and physical examination, any one of which alone is difficult to interpret, but which, taken as a group, make a suggestive and, at times, a formidable story. Then, with such a story, the special procedures of electrocardiography, fluoroscopy, and the determination of venous pressure and circulation time can be utilized. Even with these aids, it may take, as several of our records clearly show, observation for months or several years to indicate definitely the presence of cardiac damage. To increase the frequency of such diagnoses, it is proposed that all patients with chronic pulmonary disease, especially when associated with emphysema, be examined carefully by these methods.

In physical examination, special thought must be given to the evidences of right ventricular strain. This includes, aside from the obvious evidences of edema, hepatomegaly, and distended neck veins, particular attention to early findings, accentuation of P_2 , the pulmonic diastolic impact, observation of the precordium for a retraction wave, which often occurs normally over the right ventricle, but becomes more marked in right ventricular hypertrophy. It appears as a wave progressing across the precordium toward the apex and is often accompanied by a distinct systolic retraction in the epigastrium. This latter finding also occurs with a ptotic heart, in pleural effusion, and in anemias. All of these physical findings, each by itself of no great significance and frequently capable of being interpreted and explained on other grounds, when occurring together or in multiples, are of extreme importance for they then make the possibility of right ventricular disease as their cause more likely and should lead to further investigation of the patient by the methods about to be discussed. In 10 of our 15 patients, the diagnosis was first suggested on these grounds which led to electrocardiographic, radiologic, and hemodynamic studies.

Electrocardiographic studies, including chest leads, were done

in 12 of our 15 patients. In 2 instances the findings gave the first suggestions of the presence of cor pulmonale. This figure would have been higher had it not been for the alertness of the staff in establishing the physical evidences of right ventricular strain as described above. In 6 instances definite right axis deviation occurred, in 2 it was slight. In 3 patients, low complexes were present and in one nothing unusual at all. The presence and degree of right axis deviation, the determination of the axis index, the study of a series of chest leads taken from right to left across the precordium and the use of special chest leads are the most important points for consideration. The method of examination, particularly when serial tracings are available, may be of great help. This was true in 2 instances in our group.

Radiologic examination is practicable both with fluoroscopic and roentgenographic techniques. These methods, especially when the oblique views are used along with the PA views, will give much information concerning the right ventricle. In the PA view prominence of the region of the pulmonary conus may be seen at times when all other evidences are negative. In general, in our group, in which PA roentgenograms were taken, in 11 of the 15 patients prominence of the pulmonary conus was not sufficiently remarkable to give great help. However, when seen, even though only suggestive, it should lead to adequate oblique views or the use of fluoroscopy. In both oblique views encroachment of the heart shadow beyond the limits of normal may, at times, be seen long before other evidences of cardiac involvement occur. Fluoroscopy lends itself well to study of the oblique positions and we have found it most helpful in establishing the presence of right ventricular involvement. In 2 of our patients it was the only evidence present.

Hemodynamic studies by the venous pressure and circulation time determinations are simple clinical procedures. In the presence of emphysema the former may be difficult to interpret. The circulation time, especially in an alert patient, is much more frequently helpful. Of course, early in these pictures, at a time when diagnosis is most important, both these findings are normal. We have found the circulation time more reliable than the venous pressure studies in emphysema. In 2 cases, for example, with venous pressures of 110 and 130 mm of water, values not absolutely abnormal, the circulation times, arm-to-tongue, were 30 seconds and 23 seconds, respectively.

RESUMEN

El análisis de los protocolos de 15 pacientes con cor pulmonale crónico indica que (1) la presencia de enfermedad pulmonar

crónica es una indicación para que se lleve a cabo una investigación completa del corazón del paciente a fin de verificar la posible presencia de cor pulmonale, (2) las manifestaciones clínicas sobresalientes desde el punto de vista de síntomas y signos físicos antes de que aparezca la insuficiencia cardíaca franca, son índices poco valiosos de la presencia de esta enfermedad, pero signos tempranos en la historia y en el examen físico de daño al ventrículo derecho, a menudo descuidados debido a su carácter menor, son indicaciones especialmente útiles en la investigación adicional del paciente, (3) en estas circunstancias es necesario llevar a cabo una investigación especial del corazón con estudios adecuados electrocardiográficos, roentgenoscópicos y hemodinámicos a fin de establecer el diagnóstico de cor pulmonale crónico con alguna exactitud en la etapa anterior a la aparición de insuficiencia del corazón derecho, la etapa más importante en el tratamiento

SUMMARY

Analysis of the records of 15 patients with chronic cor pulmonale indicates that (1) the presence of chronic pulmonary disease is an indication to carry out a complete investigation of the patient's heart to establish the possible presence of cor pulmonale, (2) the outstanding clinical manifestations from the standpoint of symptoms and physical findings before frank heart failure appears are a poor index of the presence of this disease, but early historical and physical evidences of right ventricular strain, often neglected because of their minor character, are particularly helpful indicators for further investigation of the patient, (3) the addition of special investigation of the heart under the above circumstances with adequate electrocardiographic, fluoroscopic, and hemodynamic studies is necessary to establish the diagnosis of chronic cor pulmonale with any degree of accuracy in the stage before right sided heart failure appears, the stage most important in treatment

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The Role of Bronchoscopy in Clinical Medicine and Surgery*

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Due to the demands of the rapid progress of medical science during the past decade, bronchoscopy has come to play an important role in the diagnosis and treatment of pulmonary diseases. To quote that famous teacher of bronchoscopy, Chevalier Jackson: "Look and see is the order of the day. In every accessible region of the body, the aid of direct vision is called upon to contribute to diagnosis and treatment."¹

In the diagnosis of thoracic diseases, the internist, by means of external inspection, percussion, and auscultation, usually obtains sufficient information to establish a tentative diagnosis. His findings may be further corroborated by the roentgenologist, who by means of fluoroscopic and roentgenographic examinations has an opportunity, as it were, to look through the chest. But it remains for the bronchoscopist, by means of direct visual inspection, to look inside the bronchial tree and observe the underlying pathologic condition. It becomes evident, then, that when there exists such a close association between the internist, the roentgenologist, and the bronchoscopist, the diagnosis of pulmonary conditions is greatly facilitated.

Aside from the removal of aspirated foreign bodies in lungs, for which no procedure other than bronchoscopy is worthy of a moment's consideration, the profession at large has not realized that the greatest value of the bronchoscope is in diagnosis. A recent statistical survey of the patients admitted to several of the large bronchoscopic clinics in this country revealed that only 2 per cent of the admissions were for the removal of foreign bodies. The late Dr. Howard Lilienthal, one of the great teachers of thoracic disease, has on many occasions stated: "The scope of bronchoscopy has rapidly widened from the mere extraction of foreign bodies to the diagnosis and treatment of many pulmonary lesions, such as abscess of the lung, tumor of the lung, bronchial narrowing, bronchial ulceration, postoperative atelec-

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tasis, and as an aid to the thoracic surgeon in the localization of thoracic diseases"

In the field of diagnosis the bronchoscopist by means of direct vision is able to inspect the inside of the bronchial tree and remove tissue for histologic examination, thereby establishing, in many instances, the early diagnosis of bronchial carcinoma. In a small number of cases in which the endobronchial tumor mass is located in the smaller bronchi, beyond the range of bronchoscopic vision, the bronchoscopist, by means of bronchial lavage of the involved bronchus followed by cytological examination of the aspirated solution (normal saline) may serve as a further aid in establishing the early diagnosis of bronchogenic carcinoma. By means of special aspirators introduced through the bronchoscope, it is possible to remove purulent secretions for the relief of bronchial obstruction. Also secretions removed by this method, being free of oral contamination, assure a more desirable bacteriologic study, and are of greater value if a vaccine is to be prepared.

That bronchoscopic examination is not a hazardous procedure is best illustrated by the fact that during the past ten years, during which period the author has personally carried out over 2,500 bronchoscopic procedures, the majority of the patients examined or treated were handled as out-patients.

Bronchoscopy and Diagnosis

Carcinoma of the Lung A relatively common disease, carcinoma of the lung is responsible for approximately 10 per cent of all cancer deaths, an occurrence which is frequent enough to arouse interest on the part of the medical profession. Bronchoscopic examination with removal of the tissue for histologic study is by far the most important diagnostic procedure available, and if an early diagnosis is to be made, bronchoscopy should be employed early. In a recent study of the subject, Overholt and Rumel² call attention to the fact that approximately three-fourths of all primary lung tumors are situated in the major bronchi so that they are within range of bronchoscopic vision. His findings are in complete agreement with those of Jackson and Konzelmann,³ who in a recent article stated that bronchoscopic biopsy was positive in about 75 per cent of the cases of bronchial carcinoma. In a series of 60 cases personally examined by the author during the past ten years, a positive biopsy was obtained in 42 cases. This high percentage of positive biopsies is definite evidence that bronchoscopic examination plays an important role in the diagnosis of lung carcinoma.

The symptoms produced in primary carcinoma of the lung depends to a great extent on the degree of bronchial obstruction.

By far the most important early symptom is a dry, hacking cough accompanied by slight bronchial wheezing. Physical examination during this early stage may reveal a few coarse moist rales and asthmatic wheezing over the involved pulmonary area. Roentgenographic studies of the chest during this stage may be entirely negative since the tumor is not large enough to cast a shadow. At this time the patient usually seeks medical advice because of the cough and wheezing. In spite of the fact that no improvement is usually shown after several weeks or several months of medical treatment, very little thought is given to the possibility of bronchial carcinoma.

Slight asthmatic wheezing is a very important early symptom. It is commonly present in all cases of bronchial carcinoma. Wheezing means only one thing—partial bronchial obstruction, which may be produced by a variety or combination of conditions, among which is bronchial carcinoma. The importance of this one symptom alone cannot be too strongly emphasized. In the series of 60 cases of bronchial carcinoma bronchoscopically examined by the author during the past ten years, it was astonishing to learn that 18 of the patients, because of recent wheezing and slight dyspnea, had been previously treated for bronchial asthma. Any patient, particularly of the cancer age group, presenting this symptom, should immediately be x-rayed and should have the benefit of a diagnostic bronchoscopy. The appearance of blood-streaked sputum or frank hemoptysis are also frequent early symptoms and are usually due to the trauma of coughing and ulceration of the tumor mass. Pain, as in other malignancies throughout other parts of the body, is definitely not an early symptom.

For the purpose of clinical study, Overholt divides the clinical course of primary lung carcinoma into the following divisions: (1) the stage before bronchial occlusion, (2) the stage of bronchial occlusion, and (3) bronchial occlusion with secondary infection.

It is important that in order to increase the operability of this condition, which in the past has had a mortality of 100 per cent, and in order to take advantage of the rapid progress already made to date in the field of thoracic surgery, the diagnosis should be established early, before the stage of bronchial occlusion. By far the most important diagnostic procedure available at the present time is bronchoscopic examination (Figs 1, 2 and 3).

Benign Neoplasms of the Tracheobronchial Tree Without the aid of bronchoscopic inspection, the diagnosis of benign neoplasms of the trachea or bronchi would probably never be made except by inference. The symptoms and physical signs produced depend to a great extent on the degree of bronchial obstruction.

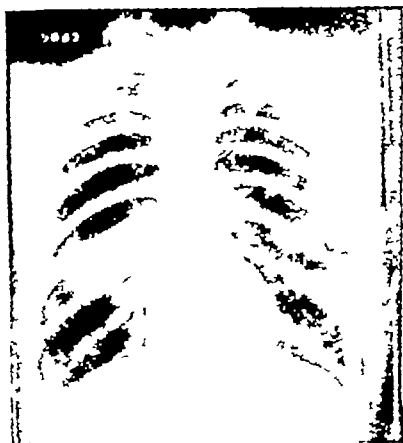


FIGURE 1



FIGURE 2

Figure 1 Radiograph of chest of male patient age 42 showing a lesion in the mid-region of the right lung. For the past three months the patient's chief complaint was coughing and bronchial wheezing. Bronchoscopic examination revealed a small tumor mass of the right main stem bronchus which encroached upon the orifice of the middle lobe bronchus. Biopsy taken of this tumor mass was reported as an epidermoid carcinoma Grade 2. He was advised to undergo a thoracic operation and in October 1942 Dr. Ralph Adams performed a total pneumonectomy of the right lung.

Figure 2 Radiograph taken in 1947 showing the characteristic appearance of chest following total pneumonectomy. For the past two years the patient has been steadily employed and except for slight dyspnea upon exertion, he is otherwise in good health. Periodic x-ray studies during the past five years revealed no metastasis.



FIGURE 3 Histological section from removed lung showing epidermoid carcinoma

and the presence of infection. It is always to be remembered that the first symptoms produced in early bronchial obstruction, regardless of the cause, are those of wheezing and coughing. If coughing is associated with blood-streaked sputum, bronchial neoplasm should always be considered in the differential diagnosis. Benign tumors of the trachea or bronchi can usually be successfully removed by bronchoscopic procedure. It is important that the diagnosis be established early, before any degree of bronchial obstruction and pulmonary infection has taken place.

Tumors of the trachea, particularly those pedunculated in type, may obstruct the egress of air, resulting in severe bilateral emphysema. As the tumor mass grows in size it may completely block the trachea causing sudden asphyxia. Because of the asthmatoïd-like wheezing and emphysema which is usually present, many of these patients give a history of having been treated for bronchial asthma.

Bronchial Stenosis This condition results from (1) inflammatory reaction produced by foreign bodies, (2) specific infections such as syphilis and tuberculosis, or (3) congenital tendencies. The clinical symptoms and physical signs produced are chiefly those of bronchial obstruction. Once the preliminary physical, x-ray, and lipiodol study suggests the possibility of bronchial stenosis, bronchoscopic dilatation should be immediately carried out. Holinger⁴ calls attention to the fact that inflammatory bronchial stenoses, if untreated, may eventually lead to atelectasis and then to bronchiectasis. Most forms of bronchial stenoses, with the exception of the well-developed fibrostenotic type resulting from endobronchial tuberculosis, are easily dilated.

Nonopaque Foreign Bodies Nonopaque foreign bodies of the bronchial tract, particularly in children and infants, present a most troublesome problem in diagnosis, since in many instances they are frequently overlooked as a diagnostic possibility. It is only when severe pulmonary reaction has already taken place that these patients are sent to the bronchoscopist for examination. Unfortunately, because of inadequate history and due to the fact that these foreign bodies are not visualized by the conventional x-ray films of the chest, many of these patients developing pulmonary symptoms, are at first treated for bronchitis or pneumonia.

In every child or infant seen for the first time, who is suffering from obvious pulmonary infection, a careful history obtained from the parents should include information regarding recent attacks of coughing and choking while eating or drinking. If wheezing is present, special note should be made regarding duration and mode of onset. A careful history thus obtained may prove to be

a very important guide in the diagnosis of aspirated foreign body

Mechanics of the Bronchial Tract In order to establish the diagnosis and to better understand the peculiar physical findings produced by nonopaque foreign bodies, it is important that one should have a basic knowledge of the mechanics of the bronchial tract during respiration. The bronchi are not rigid tubes and during inspiration they elongate and widen, conversely, on expiration they become shortened and narrowed. This constant change in the caliber of the bronchial lumen during respiration plays a major role in the production of the physical signs commonly found when foreign bodies invade the bronchial tract.⁵

As a rule, once a nonopaque foreign body, particularly those vegetal in type, becomes lodged in a bronchus, a local reaction soon follows, causing a severe edema of the bronchial mucosa which further increases the bronchial obstruction. On inspiration the bronchi being normally widened, the invasion of a bronchus by a foreign body, at first produces only a partial obstruction during this phase of respiration. Sufficient space still remains between the foreign body and the bronchial wall to allow the

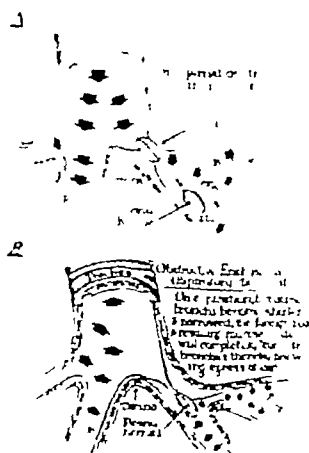


FIGURE 4

Figure 4 (A) Schematic illustration showing how a non-opaque foreign body causes only partial obstruction to the ingress of air. However on expiration (B) because the bronchi normally become narrowed and shortened the foreign body and the resulting mucosal edema will cause a complete obstruction to the egress of air. This is commonly spoken of as an expiratory check-valve.

Figure 5 If the foreign body is not soon removed the prolonged irritation and resulting local edema will completely obstruct the bronchus thereby preventing both the ingress and egress of air. The check-valve mechanism which was only expiratory in type has now changed to a complete check-valve and the state of the lung formerly emphysematous is now completely atelectatic.



FIGURE 5

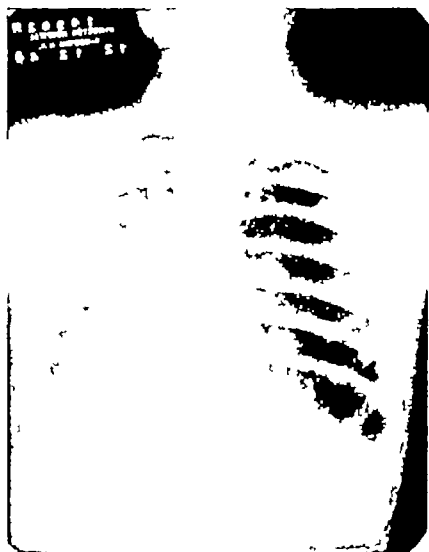


FIGURE 6

Figure 6 Radiograph of child age ten, with non-opaque foreign body in left main stem bronchus resulting in obstructive emphysema of the left lung. The mechanics involved are those of an expiratory check-valve.

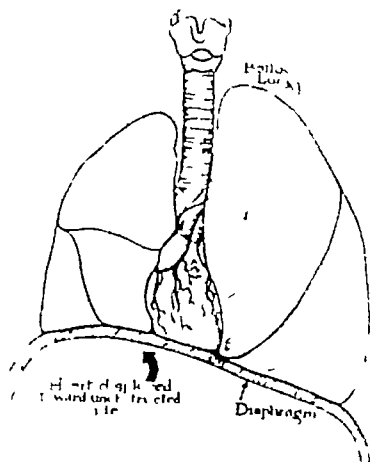


FIGURE 7

Figure 7 Schematic drawing showing the appearance of the involved lung in obstructive emphysema as shown in figure number six.



FIGURE 8

Figure 8 Radiograph of same child taken one week later showing a complete atelectasis of the left lung. The mechanics now involved are those of a complete check-valve. The bronchus is completely corked, thereby preventing both the ingress and egress of air.

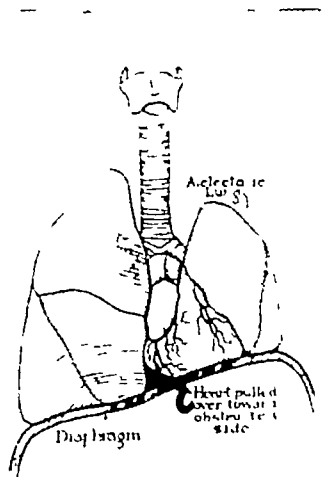


FIGURE 9

Figure 9 Schematic drawing illustrating the appearance of the involved lung in atelectasis.

ingress of air. However, on expiration the situation becomes entirely reversed. The bronchi now normally narrowed, the foreign body and the resulting local mucosal edema will in varying degree obstruct the egress of air from that portion of the lung involved. This stage of expiratory obstruction results in a hyperdistension of the pulmonary segment distal to the obstructed bronchus. In other words, a condition of obstructive emphysema is in the making. The mechanics involved in producing this condition is often referred to as an expiratory check valve mechanism. If there is any delay in the removal of the foreign body during this stage of obstructive pulmonary emphysema, the increased mucosal swelling and accumulated secretions resulting from the prolonged local irritating action of the foreign body, will now completely cork the bronchus, thereby preventing both the ingress and egress of air from that portion of the lung supplied by the obstructed bronchus. The mechanism, which previously was only expiratory in type, has now changed to that of a complete check valve obstruction and the state of the lung, formerly emphysematous, is now completely atelectactic (Figs 4 and 5).

Even during this early stage of obstructive atelectasis, the removal of the foreign body and aspiration of the retained secretions will in many instances restore the lung to its normal function. However, when atelectasis is allowed to exist for a period of time, the resulting pulmonary changes may prove to be irreversible. This last stage of complete bronchial obstruction, with



Figure 10 Radiograph of same child taken one week after the removal of the non-opaque foreign body the rubber sac of a fountain pen which had gone undiagnosed for a period of three weeks. In spite of the fact that obstructive atelectasis had existed for a period of several days the child made uneventful recovery following the removal of the foreign body and aspiration of the retained secretions.

subsequent pulmonary destruction might never be reached if every pediatrician and general practitioner of medicine would strongly consider the diagnostic possibility of aspirated foreign bodies as the causative factor in both children and infants who are suffering from obvious bronchial or pulmonary infection.

The symptoms and physical signs will vary with the degree of bronchial obstruction and with the amount of interference with aeration and drainage of the subjacent portion of the lung involved. Certain types of nonopaque foreign bodies, beans in particular, which because of their chemical structure possess the property to expand or enlarge in the presence of moisture, may quickly produce a complete bronchial obstruction, resulting in a massive atelectasis within a few hours following the intrusion. Irritating vegetal bodies such as peanut kernels will usually set up a violent reaction immediately following the bronchial lodgment (Figs 6, 7, 8, 9, 10 and 11).

Bronchoscopy and Treatment

Treatment of Lung Abscess In the field of therapy, bronchoscopic aspiration for the treatment of suppurative diseases of the bronchial tract is now a well established procedure. By no means is it necessary to recommend all cases of lung abscess for thoracic surgery. In a series of 36 cases of early lung abscess



Figure 11 Postmortem specimen of lung from female patient age 67, showing complete obstruction of right main stem bronchus by a large piece of nut. She was first seen by a physician three weeks before her death, who diagnosed her condition as pneumonia. She eventually developed atelectasis with pulmonary suppuration. When atelectasis is allowed to remain for any great length of time, the resulting pulmonary changes may prove to be irreversible and the outcome may prove fatal.

seen by the author during the past ten years, in only 9 cases was it necessary to employ surgical intervention. The 27 cases not requiring surgery made uneventful recoveries following bronchoscopic aspiration, antibiotic and chemotherapy. It is to be made clear, however, that bronchoscopic aspiration and conservative measures should be carried out only for a period of four to six weeks. If, during that period of time no improvement has been shown, either clinically or by roentgenographic study, or if at any time during this period of conservative management there appears to be a progression of the disease, surgery is immediately advocated.

The desired factor in the bronchoscopic treatment of lung abscess is to facilitate drainage from the abscess cavity. Usually the draining bronchus leading from the cavity becomes blocked by mucosal edema, thick purulent secretions, and granulation tissue. Once the affected pulmonary segment is carefully localized by preliminary physical and x-ray examinations, the bronchoscopic procedure consists of locating and draining the involved bronchus. Whenever possible, the bronchoscopic injection of iodized oil directly into the draining bronchus and into the abscess cavity will materially aid drainage by its displacement of tenacious purulent secretions. Since the advent of penicillin, streptomycin and the sulfonamide group of drugs in the treatment of many types of pulmonary infections, this form of antibiotic and chemotherapy is also employed in combination with the treatment by bronchoscopy. In several cases treated during this past year sulfathiazole and penicillin were insufflated and instilled directly into the draining bronchus. If bacteriologic examination also reveals the presence of fusospirochetal organisms, intravenous injections of neoarsphenamine are given at weekly intervals for a period of several weeks.

In the treatment of chronic lung abscess, except as a preliminary aid to the thoracic surgeon, bronchoscopy is of small value. Cases having a well-defined, densely organized abscess wall are strictly a surgical problem.

Treatment of Bronchiectasis The only treatment offering a complete cure in late bronchiectasis is lobectomy or total pneumonectomy. However, where surgery is contraindicated because of advanced age, multilobar involvement, and cardiac disease, routine bronchoscopic aspirations, postural drainage, and intratracheal instillation of penicillin and iodized oil offer a marked palliative relief to the patient. As an aid in the surgical treatment of bronchiectasis, bronchoscopic aspiration of purulent secretions immediately before, and occasionally during and following the operation, serves to reduce the incidence of postoperative com-

plications This simple procedure often proves to be a life-saving measure

Cause and Prevention of Bronchiectasis One of the most important roles assigned to the field of bronchoscopy is in the prevention of primary or acquired bronchiectasis The accumulated clinical, experimental, and post-mortem studies clearly indicate that intrinsic or primary bronchial dilatation is practically always due to infection of the bronchial wall with destruction of the elastic tissue framework, resulting from prolonged bronchial occlusion and atelectasis In the majority of cases this condition is chronic and its evolution is gradual Occasionally bronchiectasis is met with in the acute form following infectious diseases, characterized by marked bronchial irritation, as in whooping cough, influenza and measles

Children and infants suffering from upper respiratory infection with persistent aspiration of postnasal drainage material are in constant danger of developing atelectasis and finally bronchiectasis It is most important that if the condition is to be prevented and the chronic source of bronchial irritation removed, the upper respiratory infection should be eliminated Also after the successful removal of aspirated foreign bodies which have caused some inflammatory reaction, patients should be kept under observation and should undergo periodic chest examinations for a period of several months

Holinger⁴ and Tucker⁶ describe various stages in the development of bronchiectasis, in which, if bronchoscopic aspiration is frequently done and bronchial drainage is re-established, the existing pathologic process is still reversible Anspach⁷ calls attention to the so-called triangular shadows at the base of the lungs, which he regards as an area of localized atelectasis, where, under certain conditions, bronchiectasis may develop To Anspach also goes the credit for calling the attention to the value of bronchoscopic aspiration in the prevention of bronchiectasis in children presenting this basal involvement

The rapidity with which bronchiectasis develops after pulmonary atelectasis will to a great extent depend on the type and virulence of organisms present in the trapped secretions Because of the airless state produced by the atelectasis, a state of anaerobiosis is soon established If anaerobic organisms are present, they will multiply in great numbers and hasten the destruction of the elastic tissue framework of the bronchial structures Smith⁸ believes that fusospirochetal organisms aspirated from the oral cavity and always present in the secretions of obstructive lesions of the bronchial tract play a very important role in the development of bronchiectasis

The diagnosis of bronchiectasis can only be definitely established by means of pneumonography. Neither the internist nor the radiologist should attempt to make a positive diagnosis unless the above procedures have been first carried out.

Postoperative Atelectasis This development usually results from a bronchial obstruction by aspirated secretions or vomitus during or immediately following operation. The condition is more common following operations in the upper abdominal quadrants because of decreased diaphragmatic movement in an attempt to reduce abdominal pain. Although postoperative atelectasis was clearly described as early as 1910, its frequency has been fully appreciated only in recent years. Improved x-ray technic and the many papers published on obstructive atelectasis have stimulated both internists and surgeons, with the result that this condition is now a definite entity with definite clinical and x-ray evidence.

The symptoms and the observations made of this postoperative complication usually follow a rather definite pattern. Within several hours or longer, following operation, the patient complains of dyspnea, which is usually out of all proportion to the degree of pulmonary involvement. There is a sense of discomfort over the lung involved, the pulse becomes rapid, there is sudden increase in temperature, and cyanosis becomes apparent. Contrary to general opinion, the diagnosis of this condition in its early stage is dependent more upon the physical examination than the x-ray findings. Physical findings during this early stage are usually those of obstructive emphysema.

As the bronchial obstruction increases, early signs of atelectasis begin to appear. The x-ray findings in the early cases of atelectasis may reveal little or no increase in density over the lung involved, but later the shadow may be dense or homogeneous. In the more severe cases, there is an elevation of the diaphragm on the affected side, narrowing of the intercostal spaces, and marked displacement of the heart and mediastinum.

Treatment of Postoperative Atelectasis Postoperative atelectasis can be best treated by means of bronchoscopic aspiration, with the removal of the obstructing bronchial secretions. It is important that if an early diagnosis is to be established, the surgical intern and the surgeon be ever on the alert for the possibility of this complication. Fortunately for the patients who come to operation in the author's community, surgeons and internists are wide awake regarding this complication and lose no time in asking for bronchoscopic consultation. In the past, patients developing this unfortunate condition were treated for pneumonia, a procedure that was usually followed by a high mortality. Today practically all patients treated for postoperative

atelectasis by bronchoscopic aspirations make an uneventful recovery. In the majority of cases treated, there is a sudden drop in the temperature, pulse, and respiratory rate. Almost immediately the patient feels relieved of the dyspnea and is able to cough up with ease the remaining secretions. It is to be made clear however, that the diagnosis must be made early, for if atelectasis is allowed to exist for many hours, secondary pneumonia and pulmonary suppuration may develop. In several well-known surgical clinics in this country, patients exhibiting signs of respiratory obstruction are immediately bronchoscoped during the operation and again before leaving the operating room. It is a standard rule in these clinics that no patient shall leave the operating room with a "wet lung" (Figs 12 and 13).

In addition to bronchoscopic aspiration, patients developing postoperative atelectasis are administered a 5 per cent carbon dioxide-oxygen mixture for a period of five minutes at intervals of from one to two hours until respiration and pulse rate return to a normal preoperative level. Instructions are also given to have the patient frequently rotated from side to side. With this added treatment, the patient is usually able to cough up the remaining retained secretions.

Prevention of Postoperative Atelectasis In the prevention of this complication many important details should be attended to before and during the operation. One important detail is the question of heavy preoperative sedation in patients who are known to have a chronic bronchitis or sinusitis. Many of these patients spend considerable time on awakening every morning in clearing



FIGURE 12

FIGURE 13

Figure 12 Radiograph of male patient age 54, showing a well developed postoperative atelectasis of the right lung following a gall bladder operation.

Figure 13 Radiograph of patient shown in figure 12, five days following bronchoscopic aspiration.

their nasopharynx and tracheobronchial tree of accumulated secretions aspirated during the sleeping hours. If the cough reflex is depressed by heavy sedation given the evening before and on the morning of operation, these patients are not able to clear out their airways. Before giving the morning sedation, then, these patients should be encouraged to cough and clear themselves of retained secretions.

If morphine is used postoperatively it should be given cautiously since it will tend to depress the cough reflex. Atropine and acopolamine should also be used judiciously because they tend to dry up secretions, making it impossible for the delicate ciliated epithelium to move up secretions in the larger bronchi and trachea from which they can be easily expectorated.

If there is any question whatsoever of respiratory disease a complete x-ray study of the chest should be made and, if possible, operation should be postponed if the x-ray film reveals any pulmonary disease.

Bronchoscopy in Bronchial Asthma If possible, every case of bronchial asthma being contemplated for allergenic treatment should undergo a diagnostic bronchoscopy. To recall the words of Dr. Chevalier Jackson "All that wheezes is not asthma." Time and again, bronchoscopic examination of patients diagnosed and treated for this condition has revealed that the underlying cause of wheezing and dyspnea was the presence of tracheal or intra-bronchial disease in the form of neoplasm, bronchial stricture, bronchiectasis, localized atelectasis, endobronchial tuberculosis, various forms of bronchitis, nonopaque foreign bodies, laryngeal papillomata, and pressure on the trachea and bronchi from extrinsic causes (Figs 14 and 15).

The bronchoscopic findings in bronchial asthma are chiefly those of mucosal edema with congestion. The amount and character of the secretion usually depend in a large measure on the severity and type of bronchial infection present. In the chronic form of bronchial asthma secondary infection is invariably present and degenerative changes of the bronchial tract with defective ciliary function are a constant finding.

The author in the repeated bronchoscopic examination of numerous patients of all ages suffering from intractable asthma, has never observed the phenomenon of bronchial spasm to be present in the major bronchi. The constant finding of bronchial obstruction by mucosal edema with congestion has led the author to reconsider the previously accepted theory that status asthmaticus was primarily due to a spasm of the circular fibers of the bronchial wall. While the hypothesis of bronchial spasm is the one most generally advanced as the immediate cause of the

attack, it is quite probable that the factor of bronchial edema with congestion plays a very important part and that both, rather than either one alone, are involved in producing the phenomenon of an asthmatic seizure. Bronchoscopy, by means of direct inspection of the inside of the bronchial tree, affords an open door to the further study of this complex disease.

Bronchoscopy in the Treatment of Bronchial Asthma The treatment of this condition, regardless of method or combination of therapy employed, makes up one of the gloomy chapters in the history of medicine. In many instances when the attacks

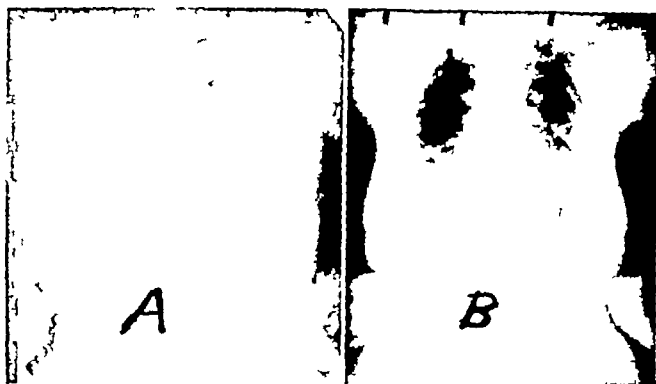


Figure 14 Radiograph of patient, (A) female age 62, who was recommended for bronchoscopic investigation, following several months of unsuccessful allergenic treatment for bronchial asthma. Bronchoscopic examination revealed a large pedunculated tumor mass arising from the posterior wall of the lower one-third of the trachea. The shifting position of the tumor mass on expiration almost completely obstructed the egress of air. The emphysematous appearance of the chest and the physical signs and symptoms present closely resembled the findings commonly seen in bronchial asthma. The tumor mass which was removed by bronchoscopic procedure in June 1942, was reported by the laboratory as an epidermoid carcinoma. (B) Radiograph taken in June 1947, reveals the disappearance of the severe emphysema as shown in figure A. This is one of the few cases still alive five years later, following the removal of a primary carcinoma of the trachea.

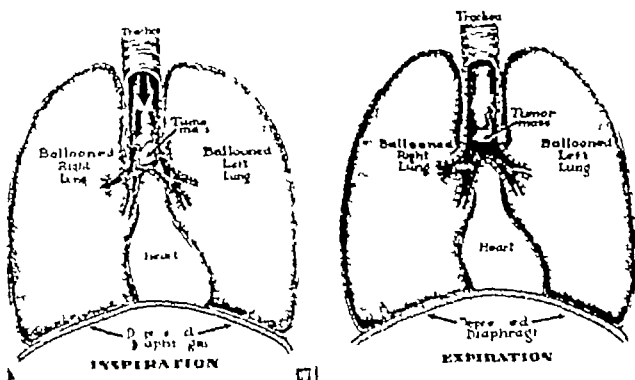


Figure 15 Schematic drawing of tumor mass of the trachea described in figure fourteen, illustrating the expiratory check-valve mechanism, which resulted in severe bilateral obstructive emphysema.

occur early in life and tend to persist and increase in severity, the patient inevitably develops chronic emphysema and sooner or later become a confirmed "asthmatic." Both the severity and duration of the seizures will determine to a great extent the rapidity with which this emphysematous state is reached.

Bronchoscopic aspiration of retained viscid secretions during an asthmatic attack which has failed to respond to the commonly accepted methods of treatment will in many instances result in the quick subsiding of the attack. Ramirez and St. George⁹ believe that bronchoscopy is of undoubted value in the so-called nonallergic forms which are associated with chronic bronchitis and bronchorrhea. The benefit is derived not only from the removal of the thick mucus and the endobronchial medication but also from the vaccines prepared from the bronchoscopically aspirated secretions. Autogenous vaccines prepared in this manner, free from oral contamination, seem to be more effective than those prepared from sputum. Clerf¹⁰ has obtained excellent palliative results following bronchoscopic aspiration of secretion in certain cases of asthma in which there was a tracheobronchitis or definite suppuration of the lung. Halliday¹¹ believes that the marked improvement and relief from distressing symptoms following bronchoscopic aspiration and instillation of medication render this procedure an important aid in the treatment.

In certain cases of intractable asthma with heavy, retained secretions not responding to any form of allergenic or adrenalin therapy, the author has obtained a marked symptomatic improvement following frequent intratracheal instillation of a 40 per cent iodized oil. The oil, because its specific gravity is greater than that of the bronchial secretion, displaces and floats the secretion into the larger bronchi and trachea from where it may be coughed up with ease. There is also a possibility that the free iodine being constantly liberated may serve in stimulating the sympathetic system in relieving bronchial spasticity. Iodized oil should not be employed in patients with cardiac disease, toxic goitre and severe pulmonary emphysema.

The author is in complete accord with Clerf, who states that before a patient is accepted for bronchoscopic treatment, systematic studies should be made to elicit all possible causative factors. The investigation should include a complete x-ray study of the chest, rhinologic examination, and a thorough allergic study.

Bronchoscopy in Treatment of Massive Pulmonary Hemorrhage

One of the immediate dangers of profuse hemorrhage is death by asphyxia. Emergency bronchoscopic aspiration of retained blood clots with relief of tracheal and bronchial obstruction will in many

instances save the life of the patient. As no time should be lost in instituting this procedure, the author recommends that bronchoscopic aspiration be quickly performed at the bedside. If the patient can be kept alive for a period of twenty-four hours the immediate prognosis is good. It might be necessary to bronchoscope the patient a number of times at half hour intervals. Often the syncope induced by the sudden loss of considerable blood aids in saving life by promoting thrombosis. When the author, ten years ago, first advocated bronchoscopic aspiration in the treatment of massive hemorrhage from pulmonary tuberculosis, he was severely criticized for recommending this type of procedure. The fact remains that the majority of patients who expire within twenty-four hours following massive hemorrhage, do not die from loss of blood per se, but rather from suffocation induced by tracheal and bronchial obstruction from clotted blood. Every patient showing impending signs of asphyxia, following pulmonary hemorrhage should be immediately bronchoscope.

In cases of repeated hemoptysis of doubtful etiology, bronchoscopy should be employed, since not only may the bronchus to the bleeding area be identified, but it may be discovered that instead of being a pulmonary lesion the hemorrhage originates from a tumor mass or an ulcer in the trachea or large bronchus, and the lesion so situated that it can be treated locally.

Endobronchial Tuberculosis Bronchoscopy has opened up a relatively new and important field in the diagnosis and treatment of tracheobronchial tuberculosis. The inexplicably bad results of collapse therapy in the past were no doubt due in part to the presence of bronchial tuberculosis, which was frequently overlooked. The importance of this condition is best illustrated by the fact that today it is a standard procedure with a great many chest physicians that all patients being contemplated for any form of collapse therapy must first undergo a diagnostic bronchoscopy to rule out tracheobronchial involvement. If the bronchial tract is involved, postponement of operation is preferred and bronchoscopic treatment consisting of topical application of a 30 per cent silver nitrate solution is immediately instituted. If in spite of repeated treatments, a well developed fibro-stenosis develops, which is soon followed by atelectasis, no time should be lost with attempts in dilatation, since this procedure is usually ineffective, and surgical intervention should be advised. A recent survey of the literature dealing with this serious complication reveals that a number of cases have already been successfully treated by means of pulmonary resection (Fig 16).

The symptoms of bronchial tuberculosis are chiefly those of partial bronchial obstruction. In some instances the obstruction

becomes complete and a state of atelectasis soon develops. This complication of pulmonary tuberculosis should always be suspected in patients who suddenly develop bronchial wheezing, elevation of temperature, decrease in the amount of expectoration, hemotysis and signs of increasing dyspnea. Auscultation usually reveals the presence of harsh rhonchi along the sternal border on the affected side. In a small group of cases with positive sputum and hemoptysis in which there is no demonstrable x-ray evidence of pulmonary disease, bronchoscopic examination often reveals the presence of tuberculous bronchial ulceration.

Many tuberculosis institutions throughout the country, realizing the importance of bronchoscopy as an aid in the diagnosis and treatment of this serious complication of pulmonary tuberculosis, have now added a bronchoscopic clinic as an integral part of the surgical department.

Bronchoscopy as an Aid to Thoracic Surgery The rapid progress already made to date in the field of thoracic surgery has been in no small way due to the aid of the bronchoscopist, who by careful endoscopic examination has aided in the correct localization of pulmonary lesions. Probably the greatest aid of bronchoscopy to the thoracic surgeon has been in the early diagnosis of primary carcinoma of the lung. In the diagnosis of tracheobronchial tuberculosis, the bronchoscopist has been of great aid to the surgeon in calling his attention to the fact that any form of collapse therapy will result in failure unless the endobronchial lesion is also bronchoscopically treated. In certain instances bronchoscopic aspiration before, during, and following thoracic opera-



Figure 16 Endobronchial tuberculosis. Fibrostenosis of left main stem bronchus resulting in complete atelectasis of left lung. This type of lesion does not respond to dilatation and no time should be lost with attempting this type of procedure. Pulmonary resection is advised for this type of case.

tions has served to reduce postoperative mortality. The advances still to be made in the field of thoracic surgery will no doubt depend in part on further bronchoscopic research on the behavior of the normal and diseased bronchi.

SUMMARY

In this brief review of the role of bronchoscopy in clinical medicine and surgery, the author has attempted to emphasize the following facts:

1) Aside from the well-known procedure for the removal of aspirated foreign bodies, bronchoscopy has come to play an important role in the diagnosis and treatment of diseases of the lungs.

2) There are many conditions of the lower respiratory tract that often remain undiagnosed because of lack of bronchoscopic study.

3) In the diagnosis of primary carcinoma of the lung, bronchoscopic examination is by far the most important diagnostic procedure available.

4) Close cooperation between the internist, radiologist, and bronchoscopist will in many instances facilitate the diagnosis of obscure conditions of the lung.

5) Many suppurative conditions of the lungs if diagnosed early, will respond to bronchoscopic and medical management.

6) Bronchoscopy is of aid in the removal of bronchial obstruction, thus preventing the development of atelectasis and subsequent pulmonary destruction.

7) Bronchoscopy is of aid to the thoracic surgeon in the localization of pulmonary lesions.

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RESUMEN

En esta breve revista de la función de la broncoscopia en la medicina y cirugía clínicas, ha tratado el autor de recalcar los hechos siguientes:

1) Además del procedimiento bien conocido de extraer cuerpos extraños aspirados, la broncoscopia ha llegado a jugar un papel importante en el diagnóstico y tratamiento de las enfermedades de los pulmones.

2) Hay muchos estados del aparato respiratorio inferior que quedan a menudo sin diagnóstico por falta de estudio broncoscópico.

3) El examen broncoscópico es, con mucho, el procedimiento más importante a nuestra disposición para diagnosticar el carcinoma primitivo del pulmón.

4) La íntima cooperación entre el internista, el radiólogo y el broncoscopista facilitará en muchos casos el diagnóstico de condiciones oscuras del pulmón

5) Muchos estados de supuración de los pulmones, si se diagnostican oportunamente, responden al tratamiento broncoscópico y médico

6) La broncoscopia ayuda a eliminar obstrucciones bronquiales, evitando así el desarrollo de atelectasia y de la destrucción pulmonar subsiguiente

7) La broncoscopia ayuda al cirujano torácico a localizar las lesiones pulmonares

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A Demand Valve for the Administration of Aerosols of Penicillin and Streptomycin*

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The efficacy of penicillin and streptomycin aerosols^{1 4} administered via the pulmonary route for the management of bronchopulmonary sepsis has become well established. Such therapy has been employed successfully in patients with the following conditions: acute and chronic infectious sinusitis,^{5 7} chronic sinusitis associated with bronchiectasis,^{5 6} acute bacterial infections,^{3 7 8} such as laryngitis, tracheobronchitis and laryngotracheobronchial edema (particularly in patients who have had a tracheotomy), bronchitis and bronchial asthma^{2 3 7 9} associated with definite bacterial infections, bronchiectasis,^{2 3 4 10 11 12} lung abscess,^{6 10} pulmonary infections^{3 6 13} due to the streptococcus, staphylococcus or penicillin-susceptible strains of *Klebsiella pneumoniae*, pulmonary infections secondary to pulmonary emphysema,^{6 14 15} lung cysts or infarcts, unresolved pneumonic infections, pneumonitis secondary to foreign bodies and tubercular infections in the lung,¹⁶ staphylococcal bronchopulmonary infections associated with pancreatic disease in children,¹⁷ and it also has been proven a valuable pre- and postoperative medication in surgery of the upper and lower respiratory tract.

Having once determined that antibiotic aerosol therapy is indicated, the technique best suited to the situation is selected. Therapeutic aerosols can be administered by the simple rebreathing technique^{2 3} which may be modified according to the age of the patient and the nature of the illness. For patients with obstructive disease of the respiratory tract, streams of helium and oxygen may be used instead of oxygen. The aerosol may be directed into tents, hoods, masks or tracheotomy openings. For patients with paranasal sinus infections the aerosol may be employed nasally with or without alternating positive and negative pressure.^{5 10} Finally, if indicated, other drugs may be substituted, alternated or combined with penicillin or streptomycin.

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Numerous factors are involved in the degree of retention of aerosols in the respiratory tract and of their diffusion into the blood stream. The following are the more important ones: (1) particle size, which depends essentially on the type of nebulizer and technique employed, (2) point of ultimate deposition of the particles which depends upon impingement, settling and diffusion by Brownian movements, (3) pattern of the ventilatory curve, particularly the respiratory rate, tidal air and the degree of bronchospasm, (4) aerodynamic factors, such as turbulence and stream line flow, and (5) factors which may influence the size and life of the particles themselves, namely stability and surface tension of the aerosols.

The selection of the proper nebulizer for the production of therapeutic aerosols is of primary importance. If very large particles are inhaled, they will be deposited in the throat and upper respiratory tract by impingement or settling. On the other hand, very small particles will penetrate to the alveoli by Brownian movement, but they will largely be exhaled. Maximum alveolar deposition occurs at some intermediary size. Nebulizers should be constructed with a suitable baffle to remove the larger particles and at the same time insure a uniform delivery of the small ones, which should preferably have the mean radius between 0.5 to 2 micra.

Bryson^{20, 21} made a critical study of the mass radius distribution of particles from two commercial nebulizers, the Vaponefrin model and the DeVilbiss No. 40. Examination of the weight-radius-distribution curve, calculated from his data on the materials delivered by these two nebulizers shows that, for all practical purposes, the mass of the particles is contained in those with radii of 0.5 or more micra. Of the two nebulizers, the Vaponefrin model appears more efficient, for it produces considerably more mass of the particles contained in the 1.0 to 1.5 micra range, and even more in the 0.7 to 1.5 micra range. Generally, a more uniform production of particles in the 0.5 to 2.0 micra range is assured with the use of the baffle plate. The quantity of the material in the very smallest particles delivered by this nebulizer is essentially negligible. Furthermore, the Vaponefrin model produces considerably less scattered large particles. This "rain" is apt to occur with most nebulizers because of their imperfect construction and it is as much of a loss as the residual liquid which adheres to the walls of the nebulizer.

We have found the Vaponefrin* nebulizer most satisfactory for the production of therapeutic aerosols. It is a glass or plastic

*Vaponefrin Co. 6812 Market Street, Upper Darby, Pennsylvania

vessel containing a special type of baffle unit and produces an exceedingly fine, voluminous mist or smoke screen, which is further refined in particle size by the baffling action of the walls of the vessel. The majority of the particles average 1 micron in radius and are thus capable of penetrating the alveoli. The nebulizer has an outlet orifice, at least as large as the diameter of the human trachea, from which the patient inspires the vapor or mist. It also has an auxiliary air jet orifice which is considerably smaller. A nipple for attachment of a hand bulb or rubber tube from an oxygen or compressed air tank provides power for the nebulizing unit (Fig 1).

When appreciable quantities (1 to 4 cc) of solutions of antibiotic aerosols are used, it is customary to operate the apparatus with a flow of oxygen at 5 to 7 liters per minute. A continuous flow of oxygen will obviously produce a continuous flow of aerosol. If the patient breathes through his mouth, with his lips pursed around the outlet orifice of the nebulizer, he will draw into his respiratory tract that amount of aerosol which is produced during inspiration, that produced during expiration will be wasted.

To compensate for this loss of aerosol, it has become customary to insert in the oxygen supply line a T or Y tube with its side arm open to the outside air, or a simple vent in the rubber tubing close to the nebulizer. When the side-arm or vent is occluded by the finger tip, oxygen is forced through the nebulizer and aerosol is produced, when the finger is released, oxygen escapes without formation of aerosol. This technique is satisfactory for ambulatory and cooperative patients who must be instructed in the exact timing necessary to prevent aerosol waste without stopping the production of aerosol entirely. However, if the patient is critically

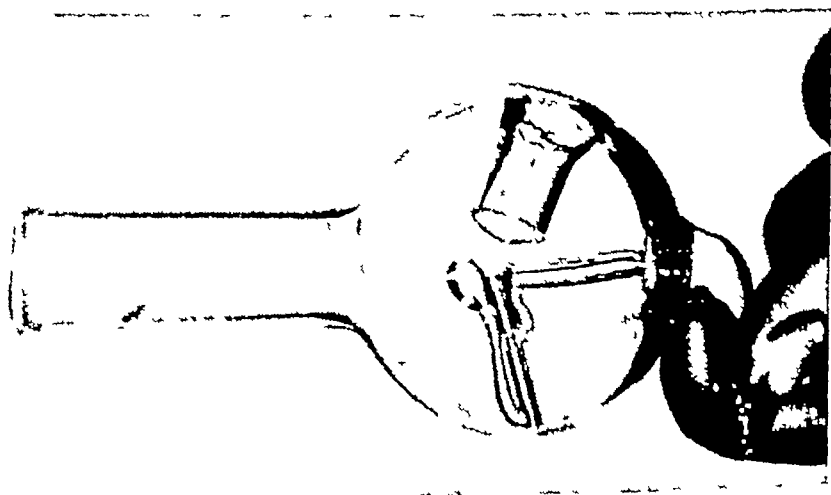


FIGURE 1

ill with bronchopulmonary sepsis, and is too toxic, disoriented or uncooperative to learn this occlusive technique, an attendant must be present constantly during the administration of penicillin or streptomycin aerosol. This procedure is not too efficient for such patients, since the administration of 1 cc of solution via the nebulizer requires fifteen minutes or more, and the attendant can only approximate the exact timing of inspiration and expiration.

Eckman, Rumsey and Barach²² have previously described a demand apparatus for the delivery of aerosols during inspiration only. It operates by virtue of the pressure differential set up within a Vaponefrin nebulizer with respiration, using that change to alter the tension in a coil spring which, via a thrust bearing, actuates a shut-off valve leading from the oxygen supply. We have found this apparatus too expensive and complex for routine hospital use.

A simpler, more useful demand valve (Fig 2) has been devised to accomplish automatically the production of antibiotic aerosols during the inspiratory phase of respiration only. It improves the efficiency of this mode of therapy by increasing the actual amounts of antibiotic inspired per dose placed in the nebulizer, it reduces the cost of such therapy, and, at the same time, it obviates the instruction of patients and personnel in the Y tube technique.

The operation of this demand valve is based upon the fact that the carburetor orifice of the Vaponefrin nebulizer is considerably smaller than the outlet orifice. Therefore, inspiration with the lips pursed around the outlet orifice will set up a negative pressure (a pressure less than atmospheric) within the chamber of the nebulizer. Oxygen flowing into the nebulizer in the ranges

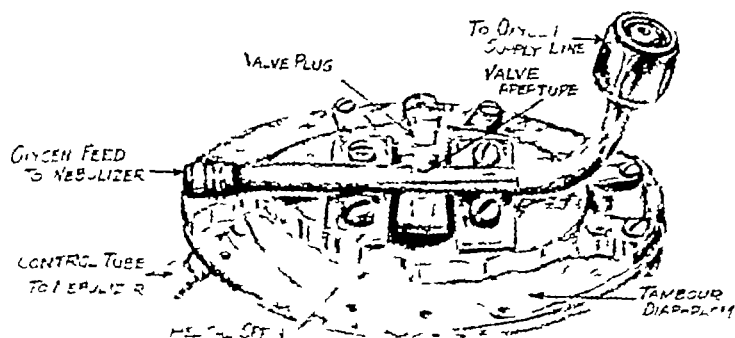


FIGURE 2

employed clinically has no effect on this negative pressure. Conversely, a positive pressure will develop during expiration.

The valve* consists essentially of a tambour type of rubber diaphragm (Fig 2). The tambour cavity is connected by rubber tubing either to a special side-arm in the nebulizer or to any portion of the nebulizer apparatus within which a pressure differential is set up during respiration. Considerable oscillation of the diaphragm is produced by inspiration and expiration with lips pursed about the outlet orifice of the nebulizer. A short length of metal tubing, which has a side orifice and through which oxygen is passed from the regulator to the nebulizer, is mounted above the tambour diaphragm. A screw type of valve plug, which fits the orifice in the side of the metal tubing, is attached to the rubber diaphragm by an L shaped arm. Below the diaphragm, and within the tambour cavity, is a helical phosphor-bronze spring, which presses upward against the diaphragm and carries the weight of the valve plug. The purpose of this spring is to make certain that the valve will always be open (and thus that aerosols will not be produced), unless the patient, by inspiration, produces sufficient negative pressure to overcome it and close the valve. The exact degree of negative pressure necessary to close the valve is regulated by changes in the tension of the spring and by adjustment of the screw valve plug. The valve may easily be adjusted to operate on a pressure of less than 2 cm of water.

*Manufactured by J. H. Emerson Co., 22 Cottage Park Avenue, Cambridge, Massachusetts



FIGURE 3

This demand valve, with the helical spring, operates upon a true demand principle, producing aerosols only when a negative pressure exists within the nebulizer. We have^{6 13 18} also employed valves without the spring, which in actual operation produces aerosol at all times except during active expiration (i.e. the positive pressure phase)

This spring demand valve, unlike the Emerson demand valve previously described^{6 13 18} is readily adaptable to any modification of the basic Vaponefrin nebulizer. The simplest apparatus is the nebulizer with a side-arm mounted in the nebulizing chamber, to which the valve is attached, with or without the large glass rebreathing bulb (Fig 3). For patients too debilitated for such a device, the nebulizer can be mounted in an Emerson plastic face mask* which has a head strap to hold it in place (Fig 4). Further modifications of design are innumerable. The only basic requirement is that the apparatus somewhere contain a chamber in which a pressure differential will be developed during respiration, so that the valve may be actuated and aerosols produced. In cases where respiration is so shallow that the valve does not close with inspiration, addition of 5 per cent carbon dioxide to the oxygen can produce the desired depth of respiration.

The exact efficiency of this demand valve for the administration of penicillin aerosol is difficult to determine. Various authors have made studies of the penicillin levels in the blood after administration of penicillin aerosol, but these levels do not neces-

*Also obtainable from J. H. Emerson Co.



FIGURE 4

sarily indicate the therapeutic value of the medication, since, in contrast to intramuscular or intravenous administration of penicillin, aerosol administration is essentially a form of topical administration to the mucosal surfaces of the respiratory tract. Aerosol therapy affords a more intimate contact of the antibiotic agent with the infecting organisms in respiratory infections. Moreover, the blood levels obtained after aerosolization of penicillin are dependent upon many factors other than the dosage

TABLE 1

Penicillin in Serum after Inhalation of 100,000 Units of Crystalline Potassium Penicillin in 1 cc of Saline Using the O.E.M. Mask Connected Directly to the Oxygen Tank Regulator

Hours After Dose	Number of Sera Tested	Per cent Positive Sera*	Penicillin, Units Per C C of Serum				Ave Units Urinary Excretion
			0 04	0 04	0 08	0 16	
1/2	9	67%	3	6			
1	8	50%	4	4			671 (10)**
2	9	0%	9				469 (10)
24							392 (6)
TOTAL	26	39%	16	10			1,532
Measurable Wastage—Mouth Wash							1,487 (10)
Apparatus Wash							18,670 (9)
Total							20,557

*0.039 unit per cubic centimeter or more

**number of tests done for average result

TABLE 2

Penicillin in Serum after Inhalation of 100,000 Units of Crystalline Potassium Penicillin in 1 cc of Saline Using the Two Liter Glass Rebreathing Bulb with the Negative Pressure Demand Valve

Hours After Dose	Number of Sera Tested	Per cent Positive Sera*	Penicillin, Units Per C C of Serum				Ave Units Urinary Excretion
			0 04	0 04	0 08	0 16	
1/2	6	83%	1	2	3		
1	6	67%	2	4			1,119 (6)**
2	6	0%	6				938 (5)
24							44 (3)
TOTAL	18	50%	9	6	3		2,101

Measurable Wastage—Mouth Wash 955 (2)

*0.039 unit per cubic centimeter or more

**number of tests done for average result

or apparatus used We^{3 16 18} have had excellent clinical results with penicillin aerosol treatment in some cases of lobar pneumonia and suppurative lung disease where the levels of penicillin in the blood were below what we now know are minimum therapeutic levels

The antibiotic levels obtained in the sputum may be more indicative of successful aerosol therapy than the blood levels. We have, nevertheless, determined the levels of penicillin* in the

*This study was aided in part by a grant from the Commercial Solvent Corporation

TABLE 3

Penicillin in Serum after Inhalation of 100,000 Units of Crystalline Potassium Penicillin in 1 cc of Saline Using the O.E.M. Mask with the Springless Positive Pressure Demand Valve

Hours After Dose	Number of Sera Tested	Per cent Positive Sera*	Penicillin Units Per C C of Serum				Ave Units Urinary Excretion
			0 04	0 04	0 08	0 16	
½	7	86%	1	4	2		
1	7	57%	3	4			883 (7)**
2	6	0%	6				709 (7)
24							936 (1)
TOTAL	20	50%	10	8	2		2,528

Measurable Wastage—Mouth Wash 1,117 (4)

*0.039 unit per cubic centimeter or more

**number of tests done for average result

TABLE 4

Penicillin in Serum after Inhalation of 100,000 Units of Crystalline Potassium Penicillin in 1 cc of Saline Using the Emerson Mask with the Negative Pressure Demand Valve

Hours After Dose	Number of Sera Tested	Per cent Positive Sera*	Penicillin Units Per C C of Serum				Ave Units Urinary Excretion
			0 04	0 04	0 08	0 16	
½	6	100%	0	2	2	2	
1	6	67%	2	2	2		1,166 (6)**
2	6	17%	5	1			2 046 (5)
24							522 (2)
TOTAL	18	61%	7	5	4	2	4,234

Measurable Wastage—Mouth Wash 7,156 (4)

*0.039 unit per cubic centimeter or more

**number of tests done for average result

serum of normal individuals following the administration of penicillin aerosols via the demand valve and face mask, and via the demand valve and nebulizer with rebreathing bulb

In Tables 1, 2, 3 and 4 we have presented these findings, the amounts of penicillin recovered from mouth rinsings and from the apparatus after use. The mouth was rinsed with 50 cc of saline and the apparatus with 1 cc of saline following each treatment. This technique was chosen to approximate more closely the one that would be carried out in the wards of the hospital. For comparison, average values with other apparatus are included. Study of the tables will reveal that this apparatus is certainly as efficacious as other types of apparatus.

SUMMARY

A mechanical demand valve for use with nebulizer and face mask for the automatic administration of antibiotic aerosols in inspiration, without waste of material, is presented. It is inexpensive, simple, yet sturdy in construction and operation and yields penicillin blood levels which are comparable to those of other methods that require training of patients and personnel.

RESUMEN

Se describe una válvula de demanda mecánica que se emplea con nebulizadores y máscaras en la administración automática de aerosoles antibióticos durante la fase inspiratoria, sin desperdicio de la sustancia. Aunque barata y sencilla, es de fuerte construcción y operación y produce niveles sanguíneos de penicilina comparables a los que se obtienen con otros métodos que requieren el adiestramiento de los pacientes y del personal.

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Tumors of the Anterior Mediastinum

A Report of Six Cases

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We are indebted to Heuer and Andrus¹ for the most complete survey of mediastinal tumors in the recent literature Hedblom² and Harrington³ in contributions to the subject pointed out the usual complications and the difficulties in handling such cases when these complications occur In referring to one of his cases Lilienthal⁴ raises the question as to whether, under certain circumstances, drainage of cystic formations accompanying some of these tumors—particularly the teratomata—is justifiable

“Early diagnosis” is the urgent demand of modern medicine In the realm of diseases of the chest we are fortunate that the presence of air, a contrast medium and low cost x-ray examinations combine to offer a presently available solution in at least one field of endeavor

Six cases of tumor of the mediastinum are reported below one lipoma, one lymphangioma, one undifferentiated and three teratomata The presence of everyone of them was signalized by a complication which made its management difficult or even endangered or cost life With the exception of Case III, a new born infant, they illustrate the long “silent period” which characterizes them They also illustrate the possibility that the complication may completely obscure the underlying disease or may so increase in importance as to require a shift in strategy by which the complication is treated first and independently (Cases V and VI) In Case V, drainage of an infected cyst was necessary as a life saving measure, although it was recognized that a chest wall sinus would impair the prognosis in a subsequent operation In Case VI, months of symptomatic and supportive treatment, including the drainage of an infected cyst, were necessary to assist the patient in recovery from a chronic empyema before the removal of her mediastinal tumor could be considered

In both cases, the procedure in retrospect appears to have proven its justification In Case V, the patient's status was changed by drainage from a bad to a good surgical risk In Case VI, a tumor, the bulk of which occupied more than half the width of the thoracic cavity, shrank to such a degree after drainage that it was completely covered by the gladiolus sterni It is even questionable whether drainage at an earlier time might not have

prevented adhesions to the right mediastinal pleura and have made possible the removal of the tumor at the final operation without rupture of that membrane

The answer to Lillenthal's question would, therefore, appear to be that under certain circumstances, drainage of a teratomatous cyst is not only practicable but necessary

The rupture of a cyst does not, of itself, prolong recovery Compare Case VI, requiring five operations and more than one year of hospitalization, with Case IV, requiring one operation and twenty-four hospital days The point of paramount importance is to avoid infection by aspiration when necessary or, better still, by operation before aspiration is necessary

In the discovery of early tuberculosis, x-ray is gradually replacing physical examination as a diagnostic method Mass surveys of apparently healthy persons and the prompt use of the x-ray for minor symptoms is the accepted procedure in the field of tuberculosis Not enough prominence has been given to the application of the same concept to the realm of other diseases The narration of experiences in the following case reports is an indication for its wider and earlier use In all but Case III, the tumor could have been discovered months, or even years earlier by x-ray, but only by x-ray, and, comparatively speaking, early diagnosis is of greater importance in nontuberculous than in tuberculous disease involving the organs of the chest This is the great lesson to be learned from a study of these reports

In addition, two new agents were used in the treatment of a pyocyaneus infection Streptomycin was found to be very effective in a concentration of 10,000 units per cc where the entire infected area could be reached by a single application The organism appeared, however, within a period of twenty-four hours, to acquire a resistance to the agent and was thenceforth unaffected by concentrations up to ten times that strength This was impressively demonstrated by its use in two adjoining wounds, one of which communicated with sinuses which could not be fully explored This wound continued to produce an abundant growth with typical green coloration while the other immediately became sterile and closed rapidly (Case VI) Parachlorophenol⁵ had an entirely different effect It inhibited growth of pyocyaneus but did not destroy the organism On culture, after contact with this drug, the typical color used for identification was not present, although the morphology remained unchanged (Case VI) In spite of this, the pathogenic properties of this usually stubborn bacillus disappeared There was prompt and continuous progress toward recovery The use of this chemical would appear to deserve the credit for saving this patient's life



CASE I, FIG 1



CASE I, FIG 2



CASE I, FIG 3

Case I, Fig 1 H.D., W.F., age 56 Posteroanterior view of the chest showing a large sharply demarcated mass in the right cardiophrenic angle—*Case I, Fig 2* A lateral projection of the chest locates the mass in the anterior mediastinum
Case I, Fig 3 Posteroanterior view of chest seven months after operation Note complete re-expansion of lung Presenting symptoms had been absent since discharge

There was no discernable systemic or local reaction in the body tissues to the drug, which was used both as an irrigation for the pleural cavity and by external application to the skin and wound in concentrations up to one per cent. Pyocyanus did not appear to acquire resistance to parachlorophenol during a period of three weeks' continuous use.

CASE REPORTS

Case I H D, white female, age 56 years. She was admitted to hospital on October 13, 1944, complaining of dyspnoea and swelling of the feet and legs. She had been treated for "heart disease" for three years. In an x-ray survey, a tumor mass had been noted occupying the right cardiophrenic angle. Lateral views localized this mass in the anterior chest (Figs 1 and 2).

Physical examination revealed shortness of breath on exertion and pitting edema of the ankles. Other findings were unimportant.

Bronchoscopic examination was carried out on October 17. No evidence of tumor within the bronchi was seen. A diagnosis of probable lipoma of the anterior mediastinum was made.

Thoracotomy was performed on October 19, under intratracheal gas-oxygen and ether anesthesia, through an antero-lateral approach in the fifth intercostal space. Short segments of the sixth and seventh ribs were resected posterior to the angle to improve exposure. A large lipoma (size of a small grapefruit) was found in the cardiophrenic angle compressing the inferior vena cava and the right atrium of the heart. It was freed with little difficulty and found to arise by a long pedicle from the pericardial fat. The tumor was removed by severing the pedicle between clamps. The chest was closed in layers without drainage. Re-expansion of the lung was effected by positive intrabronchial pressure and aspiration of the air from the pleural cavity through a needle.

Recovery was uneventful. A blood-tinged effusion was removed on two occasions. Fifty thousand units of penicillin were instilled into the pleural cavity at each aspiration. The patient was discharged on November 9. The presenting signs and symptoms had disappeared and she has since remained well (Fig 3).

The pathologist reported two masses of fatty tissue, one 13x7x5 cms and the other 5x3 cms in dimension. Microscopic examination revealed fatty tissue only.

Case II R M, white, 4 years old. Admitted to hospital May 18, 1937, with a history of pain in right upper quadrant of four days' duration following a blow received while at play. There was a past history of breech presentation at birth but otherwise normal infancy.

On physical examination there was limited respiratory movement on the right side with dullness and diminished breath sounds over the lower half of the right lung. Temperature range was from 100° to 101°. X-ray film of chest (Figs 1 and 2) showed a large, well defined mass occupying the right lower anterior chest. Other laboratory data were without significance. A right pneumothorax was induced on May 26, which demonstrated that the mass was extrapulmonary and attached at the mediastinal side. Examination by thoracoscopy on June 4, showed the mass to be about the size of a grapefruit, firm, covered by a smooth membrane resembling pleura and exhibiting many blood vessels of



CASE II, FIG 1



CASE II, FIG 2



CASE II, FIG 3

Case II, Fig 1 R.M., W.M., age 4 Posteroanterior projection showing a mass occupying the lower half of the right pleural cavity —
Case II, Fig 2 A lateral projection localizes this mass in the anterior mediastinum — *Case II, Fig 3* Posteroanterior view of chest one
year postoperative at which time the child was growing normally (Photograph reversed in reproduction)

moderate size and a number of translucent irregularities suggesting cyst formation

Operation was carried out on June 10 under gas-oxygen and ether anesthesia Incision was made through an anterolateral approach in the 4th intercostal space Adequate exposure was obtained without removal or section of ribs The growth was attached to the pericardium, lung and diaphragm by partially organized adhesions After separating these adhesions the base was found to arise from the wall of the inferior vena cava This attachment could not be separated without opening the vein and the mass was cut away without much loss of blood A No 22 F catheter was inserted in the 8th posterior intercostal space for drainage and the chest wall closed in layers

Postoperative course was marked by a temperature rise from 101° to 103° There was considerable drainage containing blood and debris which, however, remained sterile The drainage tube was removed June 28

The patient received deep x-ray therapy postoperatively, a total of 3050 r units being administered by Dr M B Radding

He was discharged on September 5, 1937 A follow-up x-ray film (Fig 3) taken one year after admission to hospital, on May 14, 1938, showed a chest of normal appearance His development has since been normal

Pathological report was as follows Specimen received in formalin in three pieces, represents an irregularly shaped mass, aggregating to the size of a tangerine Within this mass an area, composed by smaller and larger cysts, is present the size of a large pea However, the greatest portion of the tumor is composed of a firm tissue which is hard elastic and on its cut surface, grayish-white intermingled with pin-point orange-yellow areas and scattered small pin-point hemorrhages Within this tissue there are small lumena about 1 mm in diameter, present



CASE II FIG 4



CASE II FIG 5

Case II Fig 4 Section of tumor—low power showing large sinuses with coagulated serous content—Case II Fig 5 High power section of tumor showing connective tissue with scattered smooth muscle cells giant cells and phagocytes

Part of the tissue is surrounded by capsule One particle of the tumor is hemorrhagic and fleshy

"Section consists chiefly of dense connective tissue with scattered bundles of smooth muscle fibers, which apparently belong to the wall of large sinuses These sinuses are filled with homogeneous fluid There are many such large dilated sinuses Within the stroma, there are numerous nodules, varying in size, which are formed by granulation tissue including many giant cells These giant cells surround cholesterol crystals and many lipophages There are several fragments with congested lung tissue with interalveolar and interseptal hemorrhages The pleura is thickened and shows numerous newly formed blood vessels

Diagnosis Lymphangioma with chronic inflammation" (Figs 4 and 5)

Case III Baby Boy K, W M, new born Normal delivery As soon as delivery was completed, patient exhibited obstructive type respiration with cyanosis and suprasternal and epigastric retraction Bronchoscopy was performed two hours after birth with notation as follows

"New born infant's bronchoscope was passed A small amount of secretion was present The carina was displaced to the left and the right wall of the trachea and right stem bronchus bulged inward causing obstruction to breathing (Fig 1) With the bronchoscope in situ the child's condition was good but as soon as the bronchoscope was removed, dys-



CASE III, FIG 1



CASE III, FIG 3



CASE III, FIG 2

Case III, Fig 1 Baby Boy K, W.M., new born Bronchoscopic view showing compression of the right stem bronchus by an external mass

Case III, Fig 2 Anteroposterior projection showing sharply defined density in upper right chest cavity

Case III, Fig 3 High power section of tumor showing "undifferentiated" cells in a fibrous stroma

pnea and cyanosis returned This is apparently caused by a mass in the right chest cavity Patient was sent to the x-ray department for examination "

The x-ray film (Fig 2), revealed a density in the upper right pleural cavity with sharply delineated lower border at the level of the third anterior rib Within this shadow appeared two or three smaller areas of increased radiopacity The heart was in normal position The left lung was clear The findings were interpreted as "Probable teratoma of the mediastinum extending into the right pleural cavity "

The infant died two hours later An necropsy was performed with the following findings "Tumor 5-6 cm wide, in right upper chest, base attached to soft tissue around trachea and esophagus Tumor is solid, grayish-red on section

Microscopic Examination (Fig 3) Several areas are sectioned and show fine fibrous stroma, masses of cells suggestive of lymphoid tissue, and a few areas suggestive of brain tissue There are also numerous areas of oval and polyhedral cells, quite undifferentiated Organ elements have not been found in 7-8 areas sectioned The structure is that of an undifferentiated embryonal tumor "

(The base of this tumor occupied the entire depth of the thoracic cavity from the sternum to the esophagus The posterior mediastinum was not involved and there was no connection with any of the nerve trunks or ganglia It is therefore classified as a tumor of the anterior mediastinum There was no connection with the great vessels or other anatomical impediment to its removal It was proposed at the time to remove the obstruction to breathing by partially marsupializing the mass, anchoring it to the ribs and retaining a covering of skin The operation would have been completed at a second stage after feeding and other problems incidental to the new born had been solved Unfortunately the patient died before parental consent was obtained)

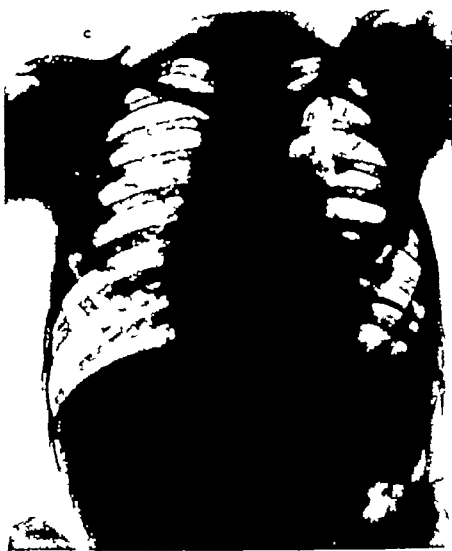
Case IV H N, W M 10 years old Normal birth and infancy Illness began January 1946 with pain in the left side and fever to 103° He was admitted to the hospital where physical and x-ray examinations indicated an effusion in the left pleural cavity Aspiration of the left posterior chest yielded clear straw-colored liquid which was sterile on culture During the ensuing six months there was improvement, but never complete recovery Occasional attacks of pain with elevated temperature (101° to 102°) occurred The x-ray shadow persisted (Fig 1) He was readmitted to the hospital after one of these attacks on July 10, 1946 Examination—particularly physical (dullness, absence and fremitus diminished breath sounds over the precordium and displacement of heart to the right) indicated either a tumor or encapsulated effusion in the left anterior chest Other data including laboratory findings, were irrelevant An aspiration in the fourth anterior intercostal space left was carried out and 120 cc of liquid having the appearance of lime water and containing large numbers of particles of black and dark green soft, waxy material were withdrawn through a No 15 gauge needle Dermoid cyst was immediately suspected, but the examination of the material was inconclusive

Operation Exploration of the left pleural cavity was deemed advisable and was carried out on July 23 Through an antero-lateral approach in the fourth intercostal space a tumor was found occupying the normal position of the heart The incision was enlarged through this inter-

space and exposure improved by removing short segments of the fourth and fifth ribs posterior to the angle. The fifth rib was also sectioned anteriorly. The tumor was found to be densely adherent to the lower lobe, the diaphragm and the pericardium. It was freed by sharp and blunt dissection and found to arise by a two inch long pedicle from the anterolateral aspect of the mediastinum behind the pulmonary vessels, but in front of the bronchus. The pedicle was severed between clamps, permitting the removal of the tumor. The cyst wall was thin in some areas and a small part of its content was expressed by manipulation into the pleural cavity. This was washed out with sterile Ringer's solution. The lower lobe, which was adherent to the chest wall in the lower axillary area, was freed. A No 22 F mushroom catheter was inserted in the ninth posterior intercostal space for drainage. The chest wall was closed in layers. The lung was re-expanded by intratracheal pressure and aspiration of the air from the pleural cavity through the drainage catheter.



CASE IV, FIG 1



CASE IV, FIG 3



CASE IV, FIG 2

Case IV, Fig 1 H.N., W.M., age 10. Posteroanterior view of chest showing "residual effusion" in left base and displacement of heart to the right (Previous x-ray said to show obscurity of entire left hemithorax, not obtainable).

Case IV, Fig 2 Section of tumor x460 showing adenomatous formations in a fibrous stroma together with columnar type epithelium suggesting bronchial or intestinal mucosa.

Case IV, Fig 3 Posteroanterior view showing condition of chest, three months postoperative at which time patient was clinically well.

The drainage tube was removed on the third postoperative day and the chest was twice aspirated on July 26, of 300 cc of turbid amber fluid and on July 27, of 400 cc of clear amber fluid. The patient was discharged on August 3, the eleventh postoperative day and has since remained well.

The pathological report is as follows: "The cyst measures 10x12 cm in diameter, when partly emptied of fluid. The latter was cloudy with considerable yellowish-green powdery material showing no structure on smear, but evidently being keratin and debris, the fluid contained no pus and no hair. The cyst wall is 1x1.5 cm. in thickness, except where a polypoid structure consisting of fatty tissue, 7x8 cm. wide, is attached to it. The cyst wall around the base of this is fibrous, with a number of small cysts, containing mucoid material. No bone is found. The cyst lining is smooth, yellowish with a few short hairs, and a small amount of yellow sebaceous and fatty material.

A number of areas are sectioned, and show a variety of structures. There is fibrous tissue, and smooth muscle, and adjacent groups of mucous glands—salivary gland or bronchial mucosa type—and areas of columnar respiratory type lining epithelium. A small area of cartilage is found, also small areas of intestinal type mucosa, considerable fat, and sebaceous glands. No areas of pancreatic or thyroid tissue are found. No areas of malignant epithelial hyperplasia are found (Fig. 2).

Diagnosis: Dermoid cyst, left pleural cavity."

The roentgenological condition of this patient's chest on October 18, 1946, is shown in Figure 3.

Case V B R, W F, 34 years old. Normal birth and development. The patient was able to engage in the usual activities at school, although she noticed that her fingers were clubbed at the age of about 14 years. She had had a cough for "several years." In the summer of 1945, she went swimming in lower New York Bay. During one of these outings, she aspirated water into the lungs. On the following day, she had a chill, followed by a cough. She was admitted to the hospital on July 28, 1945, with a fever of 104°-105° and a cough productive of 8 ozs of foul-smelling yellow sputum daily. R.B.C. 3,450,000, W.B.C. 19,400. There was evidence of consolidation of the left upper lobe and the x-ray film (Fig. 1) showed a large cavity and fluid level. Bronchoscopy was carried out on July 31, 1945 and drainage was found from the left upper lobe bronchus. Bacteriological and pathological study of aspirated material gave no important revelations. A diagnosis of lung abscess was made. Under conservative methods, the course of disease was unsatisfactory. Localizing films showed multiple fluid levels, which were not constant. A first stage pneumonostomy was performed on August 28, 1945. The pleura was free and a second stage was carried out on September 2, 1945. A large cavity was entered but due to an exceptional amount of bleeding, de-roofing had to be limited to an opening of only about one-half inch in diameter.

Temperature returned to normal and cough almost disappeared. Although after iodized oil injection (Fig. 2) it was felt that lobectomy would be necessary for complete cure, the patient was allowed to go home. Drainage continued from the sinus and finally, the patient exhibited a yellow hair about $\frac{3}{4}$ inch long, which she said she had coughed up. She was readmitted to the hospital on November 17, 1945. On November 20, 1945, in spite of considerable bleeding the cavity was visually



CASE V, FIG 3



CASE V, FIG 2



CASE V, FIG 1

Case V, Fig 1 B.R., W.F., age 34 Admission x-ray showing large 'abscess' cavity in left upper lobe with fluid level — Case V, Fig 2 X-ray of chest two months after drainage of "abscess" and following lipiodol injection into cavity through external opening Note multiple loculations and communication with bronchi The two masses of lipiodol below the safety pin are outside the body—Case V, Fig 3 Anteroposterior view of chest showing patient's condition six months after operation At the time she was free of symptoms

explored. It was found to be a part of a teratomatous cyst extending from the mediastinum into the left upper lobe, communicating with several bronchi and containing a large bundle of brownish-yellow hair. The sinus was allowed to close to a diameter of about $\frac{1}{4}$ inch and, on December 27, 1945, a left upper lobectomy, with removal of the mediastinal tumor and excision of the draining sinus, was carried out in a single stage operation.

Operative Technique The thorax was opened along the 5th intercostal space. Individual ligation technique was used, but due to the density of inflammatory reaction, was not completely feasible. In removing the mass from the mediastinum, the phrenic nerve was cut. The anterior sinus, after resection, was closed with muscle and skin and drainage was provided through the ninth posterior intercostal space.

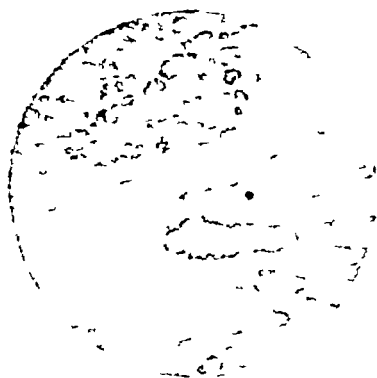
Convalescence was complicated by the development of an empyema, but was otherwise without important events. The patient was discharged on March 29, 1946 and has since remained well. The present appearance of her chest is shown in Figure 3.

Pathological examination is as follows (Fig. 4): "The specimen consists of the upper lobe, left lung showing a well defined cyst 8x10 cm wide, anteriorly, communicating with a bronchus. The lung tissue is reddish and firm. The cyst wall is firm and pale yellowish throughout and from 1.5-2 cm in thickness. The inner surface is smooth. The cyst still contains a few strands of hair."

"Several areas are sectioned, and show fibrous tissue with squamous tissue, sebaceous gland tissue, and columnar mucus-secreting epithelium. In some parts, on the inner surface the transition from columnar mucus-secreting epithelium to squamous epithelium is clearly defined. Other tissue rudiments, such as thyroid, are not found. No malignant change is found. Further sections of cyst wall show well defined pancreatic tissue, with islet tissue also."

Diagnosis 'Teratoma left lung upper lobe'

Case VI E S, W F, age 16 years. Normal birth. No dyspnoea, no difficulty in infancy. She was able to engage in normal activities in school.



Case V Fig 4 Microscopic section $\times 200$ showing variety and irregularity of structural formation from glandular type to cystic arrangements lined by cells of differing morphology



CASE VI, FIG 3

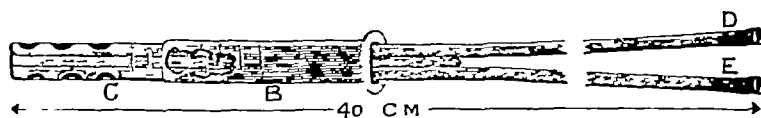
CASE VI, FIG 2

CASE VI, FIG 1

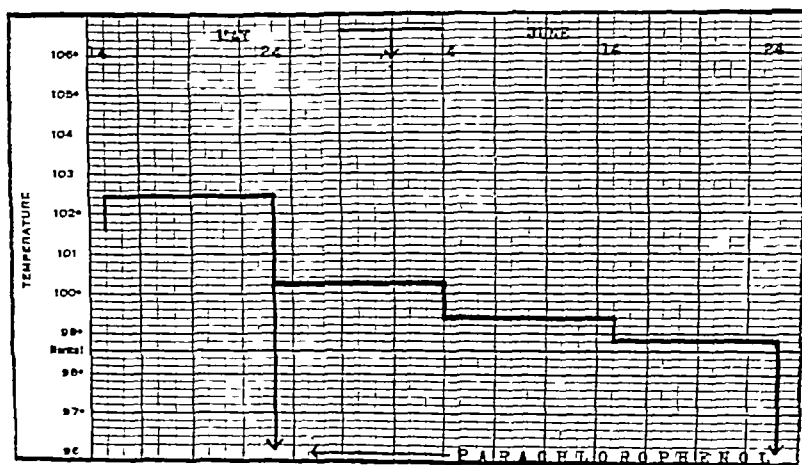
Case VI, Fig 1 ES, W.F., age 16 Posteroanterior view of chest showing a tumor occupying half the width of the thoracic cavity and beginning obscuring at the left base This examination was made after deep X-ray therapy with no reduction in size of tumor—Case VI, Fig 2 Posteroanterior view of chest after a second episode of "pleurisy" Chest tap after this x-ray yielded 300 cc of yellow turbid fluid sterile on culture—Case VI, Fig 3 Lateral view of chest following evacuation of fluid Note double fluid levels, one at the third rib anterior and one at the ninth rib posterior

On January 3, 1945, she suffered a severe pain in the left chest and was examined by a doctor who diagnosed it as "pneumonia." On January 12 an x-ray film was taken (Fig 1) It showed a large mass in the mediastinal area extending into both lung fields. Electrocardiograph, blood Wassermann and other examinations were made without important revelations. Deep x-ray therapy was started on January 22, and the patient received a total dose of six treatments of 200 r each (1200 r), 92 K V and 10 M A, following which her menses disappeared for a period of two years. The patient was admitted to the hospital on February 12, where a diagnosis of subacute bacterial endocarditis was made. This was followed by another episode of "pneumonia or pleurisy" (Fig 2). She was admitted to a second hospital on April 9. On April 10, an aspiration was made of the left chest posteriorly, at which time 300 cc of yellow, turbid fluid was obtained. The laboratory examination of this showed no growth. Intercostal drainage was instituted in the 8th left intercostal space posteriorly on April 19 and the tube was left in situ for two months without improvement. Her weight at this time was seventy-eight pounds.

The patient was examined on June 24, 1945, at which time the x-ray film showed a double fluid level (Fig 3). There was a purulent drainage from the posterior thoracotomy wound. An exploratory thoracotomy was decided upon and this was carried out on July 5, at which time a large purulent collection was found in the posterior pleural cavity, with an anterior pocket lined by a thick fibrous membrane. No communica-



Case VI Fig 4 Two way catheter used in this case for the maintenance of constant irrigation of the pleural cavity under constant negative pressure



Case VI Fig 5 Postoperative temperature record showing average elevation in the day periods beginning ten days before and ending thirty days after the use of parachlorophenol 1 1000 to mediastinal pyocyanus infected wound

tion with the mediastinum could be found. The wall of the anterior pocket was divided by sharp dissection. In view of the chronicity of the condition, a large drainage opening was left.

Her condition still failed to show improvement and, about the middle of July, edema of the lower extremities developed. This edema gradually spread upward until the whole body was involved. At the same time, frequent bouts of fever from 103°-104° occurred, accompanied by large quantities of blood in the urine. Urinalysis at this time showed numerous R B Cells, granular casts and a one plus albumin. Serum proteins: albumin, 3.7 per cent and globulin, 3.2 per cent. Congo red test was negative. A diagnosis of acute nephritis was made.

On August 8, treatment of the empyema was begun with the author's two-way catheter (Fig 4) in the wound and constant saline irrigation was employed under negative pressure. Gradual improvement was noted. On September 16, the patient was discharged without edema, but was not considered a good surgical risk at the time. The posterior thoracic cavity was obliterated, but a small sinus from the anterior pocket still remained. Throughout the course of this admission, there was a persistent pyocyanus infection, both in the wound and on the dressing. After seven weeks' rest at home, the patient was readmitted with a chest wall abscess below the left breast. On November 14, this abscess was drained by resection of the fourth and fifth ribs, both of which were found to be denuded of periosteum. The sinus was followed to the level of the second interspace and through and through drainage was established by Penrose tube. Pure cultures of pyocyanus were obtained from the wound. All the usual agents were employed to combat this infection without result. The Penrose tube was removed on November 26 and the wound packed with a solution of streptomycin (10,000 units per gram) with an immediate clearing of the typical color and odor of this organism from the dressing. The lower wound closed rapidly. The upper remained open and continued to yield pyocyanus on culture. From this time onward,



CASE VI, FIG 6



CASE VI, FIG 7

Case VI, Fig 6 Posteroanterior projection of chest two months after discharge from hospital. The wound remained completely healed and the patient was symptom free—*Case VI, Fig 7* Microscopic section of tumor demonstrating glandular formation with nearby hollow structure lined by bronchial type epithelium with underlying lymphoid tissue.

the growth did not appear to be influenced by streptomycin, although the wound was packed with paste containing a concentration of 100,000 units per cc of the agent. On January 28, 1946, the residual sinus was explored after injection of methylene blue and was found to enter the mediastinum. An exposure was obtained by resection of segments of the second and third ribs and a nodule was removed for microscopic examination. This showed a mixture of tissues of entodermal, ectodermal and mesodermal origin—characteristic of teratoma. Again, the ineffectiveness of streptomycin was demonstrated, indicating the rapidity and permanency with which pyocyanus developed resistance to this preparation. There was, however, further improvement in the patient's condition. A total gain in weight of twenty-four pounds was registered. Temperature was normal. The urine was clear. The patient was discharged on March 28 with a drainage tube in the anterior mediastinum and a persistent pyocyanus infection. On May 6, she was readmitted for removal of the tumor. Her general condition was now excellent: weight, 112 lbs., no edema, urine clear, and R B C count 4,000,000. The operation was carried out on May 14, under intratracheal gas-oxygen and ether. A "U" shaped incision was made, based on the left border of the sternum. The gladiolus sterni was turned to the right by fracturing the cartilages on that side. In effecting this exposure, it was necessary to remove the periosteum from the under surface of the bone, since this was the only line of cleavage that could be safely followed. The tumor, which was the size of a small, somewhat flattened orange and in the shape of an hour-glass, was found to be bound down by dense adhesions on all sides—to the mediastinal structures, the pericardium and the great vessels. The upper half was below the manubrium sterni and seemed to be incorporated with the thymus. Both segments required a tedious process of both sharp and blunt dissection, during which the mediastinal pleura on the right was opened. There was momentary dyspnoea and cyanosis, which was rapidly overcome by management of pressure in the anaesthesia circuit. An attempt to repair the opening proved futile, due to the fragility and looseness of the structures available. The wound was packed with loose gauze containing 100,000 units of penicillin over a Penrose drain. The gladiolus sterni was brought back into position and stabilized satisfactorily by skin sutures only. A No 24 F mushroom catheter was inserted in the ninth posterior intercostal space for drainage of the right pleural cavity.

The postoperative course was as follows. The temperature rose to 103° and there remained for the first ten postoperative days (Fig 5). There was a predominating growth of pyocyanus from the wound and gradual sloughing of mediastinal fat, together with spread of the infection, although the opening into the right mediastinal pleura closed during this time. A large number of chemical agents were used for packing and irrigation—including streptomycin paste up to 100,000 units per cc—but without effect. At this point, it was possible to obtain a supply of parachlorophenol for the purpose. One application of solution 1:2000 was used to test the reaction to the skin and tissues. There was none. The dressing was then changed three times daily, using a dilution of 1:1000 of the agent. There was immediate improvement. Within forty-eight hours, sloughing had stopped and healthy granulations began to appear. The pleural cavity was also irrigated through the tube with the same solution. Despite rapid and continued improvement, pyocyanus was cultured from both the mediastinal wound and the pleural cavity.

for the next three weeks (June 14) On June 15, the tube was removed from the pleural cavity The sinus was kept open by a grooved director for a few days The anterior dressing was changed once daily The patient was discharged on June 27 and has since remained well The appearance of the chest on August 28 is shown in Figure 6

Pathological Report "Gross Examination The specimen is 9 cm long, 5 cm wide, smooth posteriorly and presents a number of glistening, smooth nodules on the anterior surface The nodules vary in size, measuring 1.5x2.5x3.0 cm in diameter, with wide bases Several nodules are pale throughout and suggest fatty and fibrous tissue The surface shows a few hairs Other nodules are reddish on section Bony areas are not encountered There is also a second specimen, 3.5x3.2 cm in size, reddish on section

"Microscopic examination A number of areas are sectioned (Fig 7) and these show the varied histological structure which may be found in teratomata The pale nodules show a squamous surface layer, then fibrous tissue and fat, and a few acini of columnar intestinal type epithelium Small areas of cartilage are found Other parts show considerable glandular tissue suggestive of fetal thyroid or of pancreas, as noted in the biopsy specimen Adjacent to the glandular tissue is a small lumen lined at one side with columnar bronchial type epithelium, then changing to squamous epithelium with subepithelial lymphoid tissue The tissue examined shows no evidence of malignancy

"The second specimen—reddish—shows thymic tissue—lymphoid tissue with scattered Hassall's corpuscles There is also some fibrous tissue here, but teratomatous elements are not found Inflammatory changes are not found, except for slight lymphocytic infiltration in an area on the surface of a nodule, where the squamous epithelium appears eroded

"Diagnosis Teratoma of mediastinum, benign Thymus gland "

SUMMARY

1) Six cases of tumor of the anterior mediastinum are reported Five of these were treated surgically with clinical cures in all cases

2) One of them was an "undifferentiated tumor" in a new born infant producing obstructive dyspnoea and death This patient also could probably have been saved if permission for operation had been granted

3) The importance of avoiding complications particularly infections by early and correct diagnosis is demonstrated

4) X-ray examination is shown to be the only method by which early diagnosis can be made It is urged that the same importance be assigned to nontuberculous as to tuberculous diseases of the chest in the application of the technique of mass x-ray survey and follow-up

5) The value and necessity of measures designed to save life or prepare the patient for curative surgery are brought out These may include the preliminary drainage of the cystic portions of teratomata or dermoids

6) Streptomycin is shown to be an effective agent for the control of pyocyanus infection in its pathogenic phase if there are

no sinuses or pockets and if the entire infected area can be reached by the first applications. The organism, however, develops a rapid resistance to the agent if it is not immediately destroyed.

7) The value of parachlorophenol in the control of pyocyanus infection is demonstrated. This agent appears to exert a bacteriostatic action upon the organism. There is no reaction from the body tissues and the effectiveness of the drug does not appear to be diminished by continued use.

Pathological report on Case II was prepared by Dr. M. Freund, on all other cases by Dr. M. Penke.

Anaesthesia in Case II was administered by Dr. Joseph Takach, in all other cases by Dr. M. Swick.

I am indebted to Dr. F. Meleney for assistance in obtaining parachlorophenol and for his advice in respect to its use as well as to Merck and Co. who contributed a generous supply of the drug.

I wish, also, to pay a debt of gratitude to the following physicians and surgeons for advice and assistance freely given: Dr. Thomas Galvin, Dr. William Watson, Dr. Edward Robitzek and Dr. Kenneth Kahn.

RESUMEN

1) Se informa sobre seis casos de tumores del mediastino anterior. Se trató quirúrgicamente a cinco con curaciones clínicas en todos los casos.

2) Uno de ellos fue un "tumor no diferenciado" en un recién nacido, que produjo disnea obstructiva y muerte. Probablemente se podría haber salvado también a este paciente si se hubiera otorgado permiso para la operación.

3) Se demuestra la importancia de evitar complicaciones, particularmente infecciones, mediante el diagnóstico temprano y correcto.

4) Se demuestra que el examen radiográfico es el único método por medio del cual se puede hacer el diagnóstico temprano. Se urge que se le dé la misma importancia a las enfermedades del pecho no tuberculosas como a las tuberculosas en la aplicación de la técnica de censos radiográficos colectivos y observaciones consecutivas.

5) Se ponen de manifiesto el valor y la necesidad de emplear medidas de salvar la vida y preparar al paciente para la cirugía curativa. Estas medidas pueden incluir la canalización preliminar de las partes quísticas de teratomas y dermoides.

6) Se demuestra que la estreptomycin es un agente eficaz en el control de infección piocianica en su fase patogénica, si no existen fístulas o bolsillos y si las primeras aplicaciones pueden alcanzar a la entera zona infectada. Sin embargo, el germen desarrolla una rápida resistencia al agente si no se le destruye inmediatamente.

7) Se demuestra el valor del paraclorofenol en el control de infección pociánica Este agente parece ejercer una acción bacteriostática sobre el germen No ocurre reacción en los tejidos del cuerpo y la droga no parece perder su eficacia con el uso continuado

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The Combined Thoracoplasty*

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We shall begin our address by analysing the *weak points of thoracoplasty*. As a general rule, we must expect some after-effects of thoracoplasty which include cardiac disturbances, retention of bronchial secretions, reactivation of the lesion and fresh disseminations. The surgical shock is first held responsible for these complications, and perhaps, to a greater degree the sudden pulmonary collapse, which results not only in an abrupt tuberculin shock, but sometimes in the release of a veritable flood of toxins. I am far from wishing to contradict these conclusions drawn from surgical risks, yet, I see the principal danger in the *unphysiological state of the thorax, caused by thoracoplasty*. Every surgical intervention which alters the anatomy of a certain organ, harms it and disturbs its functions.

Thoracoplasty creates difficulty in breathing, this being of a paradoxical nature in the resected part. The mediastinum having lost its normal balance between the two lungs, now follows the paradoxical movements of the operated side, and thus the breathing capacity even of the sound lung is reduced. The inevitable paradoxical retractions and expansions of the unsupported thoracic wall set up a *traction irritation upon cortical lesions*. This mechanical trauma reaches its height in the region between the rib stumps and the resected part. Because an active and superficial focus is partially attached to the rib stump and the remainder is situated in the resected region, with each breath and particularly with each cough, half the lesion is retracted while the other half is inflated.

An even greater danger for the patient is the physiopathologic disturbance which results from the *difficulties in expectoration*. Let us consider the normal cough. The glottis is closed, the diaphragm descends, abdominal pressure at its height and then the ribs move inward abruptly. By this means, a reduction of the thoracic space takes place, causing maximal tension in the bronchial system. Now by the sudden opening of the glottis, air and sputum under pressure are driven out, one might almost say spouted up through the trachea. The question now arises of how

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does this cough and expectoration materialize after thoracoplasty. The increase in intratracheal pressure, indispensable to coughing, is hampered because the thoracic cage, in the resected area, cannot contract and worse still, is blown out like a hernia. We see therefore that this lack of pressure can only be compensated for, by strengthening the coughing process, so that free expectoration is nevertheless ensured.

Discomfort after the operation is not only distressing, but also constitutes a considerable danger. About the first fortnight after thoracoplasty coughing hurts the patient because the anterior rib stumps dig into the wound. He inevitably restrains himself so as to avoid this pain. The patient who is bound to have a faulty mechanical action of expectoration, should, on the contrary, attempt to intensify the coughing. *Retention of sputum*, is therefore to be expected, and it will result in toxemia, which in turn is further aggravated by mechanical irritation and reactivity of superficial lesions. Increased tissue destruction, fresh disseminations, specific bronchial pneumonia are all to be noticed. It is truly a vicious circle, which persists until the ribs are regenerated. *Thoracoplasty is, in my opinion, an unphysiological intervention, and it is to this fact that I especially attribute postoperative pathologic changes.*

From this conception, I have looked for a collapse therapy method which will safeguard to the utmost limit the physiologic status and in consequence, pays due regard to the thoracic and pulmonary functions. In theory, a natural and adequate covering is obtained in the region of the scapula, and there only. In practice, this small thoracoplasty with the posterior-lateral part of four or five upper ribs only, does not get us very far, as the resulting pulmonary collapse is not in itself of sufficient effectiveness. We must therefore endeavour to complete it by other means. As accessory collapse-therapeutic factors I suggest

1 *The resection of five to six upper intercostal nerves (with the exception of the first one).* We thus obtain a paralysis of the frontal costal rib stumps, which now drop and turn inwards in conjunction with the retraction of the lung. We get therefore, a decrease of the thoracic cage in its anterior-lateral section and, a matter of no little importance, an insensibility of the whole field of operation.

2 *The luxation of the shoulder blade into the thorax.* The scapula can well provide the support needed after the removal of the four to five upper ribs, and in addition, gives us an osteo-muscular filling by diminishing in an effective manner the posterior-lateral region of the thoracic cage down to the eighth rib.

3 To facilitate the enclosure of the shoulder blade, we must

create a pneumolysis, starting from the first intact rib, in other words, from the fifth or sixth and continuing towards the base *This extrapleural basal detachment* can be enlarged according to the general position and dimension of lower lesions

The characteristics of the combined thoracoplasty are as follows a considerable diminution of the thoracic cage in its upper part, with complete cohesion of every particle so there are no paradoxical movements Breathing and circulation are in no way hindered, the patient may cough painlessly and expectorate freely We have no reason to fear aggravation of the lesion, fresh disseminations or bronchial pneumonia *None of the four collapse-therapeutic factors of this method meets our requirements of its individual merits, but by uniting them, we gain an ideal relaxation of the lung and safeguard the physiologic state of this organ*

Combined thoracoplasty should be done in two stages For grave cases it is better to divide the shock The first stage (ie, the resection of the third and fourth ribs as well as their intercostal nerves), is a test not only of the reactivity of the lesions in question, but of the effect upon a process in the other lung and upon extrapulmonary foci *Besides these, there is an absolutely primordial reason which obliges us to operate in two stages* After the first stage, the pleura in the resected part thickens and becomes as hard as cardboard The vasculo-muscular network and the wound exsudate cause the thickening of the pleura At the second stage, the collapsed lung protected by the hardened surface slips lower down We thus avoid the dangerous trauma which the movements of the intrathoracic scapula could cause to the cortical lesions

One mechanical impediment of thoracoplasty is the space between the *scapula, mediastinum and clavicle* During the resorption and organization of the wound exudate, the collapsed lung is irresistably drawn towards this noxious space which has the form of a trihedron, the *dead trihedron of thoracoplasty* (a partial reexpansion of the lung apex after the intervention is unavoidable since nature abhors a vacuum) The inconveniences arising from the empty space between the shoulder blade and the resected thoracic dome are well known Archibald uses a muscular filling, Lillenthal, fat, DeWinter suggested an intrathoracic luxation of the shoulder blade, but had to give it up because in some cases severe pain immobilized the scapula and in others the cortical lesions were traumatized, Adams, Steinke, John Alexander, Villani, Coryllos Holman Torning, Overholt, advise the resection of the lower part of the scapula to avoid these drawbacks The intrathoracic dislocation of the scapula allows us to diminish the "dead trihedron" The shoulder blade, by drawing nearer to the

clavicle, closes this vacuum from behind like a door, the acromioclavicular joint acting as a hinge

To sum up, the intrathoracic scapula plays two parts. It serves both as a filling and as a support for the resected chest-wall. The resection of the intercostal nerves has a triple function. First the wound is made insensible, a great benefit to the patient. By this means, expectoration is eased. Furthermore, intercostal neuralgia arising from the pressure or the pendulous action of the intrathoracic shoulder blade is thus avoided. With the resection of the intercostal nerves, we therefore prevent the fixation and the consequent stiffening of the arm through pain. Lastly, the nerve resection is a therapeutic factor, par excellence, since the costal breathing of the hemithorax is reduced. Basal pneumolysis completes the collapse in the lower parts. This then is the description of the weak points of thoracoplasty and of their remedy. *But it is only by extending the field of indication, by improving the results and by reducing the complications, that we can prove the superiority of our method.* Otherwise all analysis is and remains purely theoretical.

We are often receiving patients for treatment who had been refused active intervention. We had in 120 combined plastic operations, only 33 cases which had the usual indication and 87 cases where the indication was a risky one. The results from these 120 patients are as follows:

Good, 70 per cent. Inactivity of all tuberculous lesions, intra or extrapulmonary, negative for tubercle bacilli.

Incomplete, 16.7 per cent. Healing perhaps still possible by further surgical treatment.

Direct deaths, 3.3 per cent. Operation or too risky indication responsible, patient dying within six months after the intervention.

Indirect deaths, 5.8 per cent. Without any relation to the intervention, but aggravation of tuberculosis could not be stopped despite thoracoplasty, death from six months to years after operation.

Independent deaths, 4.2 per cent. War, accidents, suicides, etc.

We are not considering the surgical technique, because in 1946 it has already been dealt with by Dr. Willenegger, formerly a surgeon on our staff, in *Helvetica Chirurgica Acta*, but we should like to draw your attention to several advantages of the combined thoracoplasty.

We get very few uni- or contralateral disseminations. We have even been able to perform thoracoplasty upon cases with a cavity in the opposite lung. We hardly ever notice an aggravation of extrapulmonary foci after the operation.

Steinlin proved by spirometry, that as a rule combined thora-

coplasty in no way reduces the respiratory function, and there is no lack of oxygen, a special advantage indeed for double collapse therapy On the contrary, Cournand and Dickinson emphasize the fact that in every case with diminished pulmonary function before thoracoplasty, this function is afterwards still further reduced

The arm movements are as easy as after other thoracoplastic methods The absence of severe surgical shock is striking Sixty-six operations were performed upon out-patients, all of whom were able to leave the Sanatorium on foot, on an average of 74 days after the operation

The fact that out of 268 operations, we have not had a single case of infection is equally striking, although our asepsis is nothing unusual The healing per primam must be attributed to the surgical method The intrathoracic shoulder blade acts as a muscle filling, in accordance with the surgical treatment of accidents, where to prevent infection, a gaping wound is protected as far as possible by a muscle transplantation

The method is at least as effective as an eight rib thoracoplasty Thanks to the three accessory collapse-therapeutic factors, lesions below and anterior to the resected ribs can still heal Should a cavity remain open, combined thoracoplasty can be easily enlarged, as it constitutes a key position in collapse mechanism, and there is nothing to prevent us from continuing with the vertical and horizontal reduction of the thorax

Some Special Therapeutic Problems

Complete basal pneumolysis to avoid postoperative reactivation of basal foci, example

A small cavity was present in the right apex, and there was slight dissemination in the base of the same lung The x-ray film, taken 9 days after combined thoracoplasty showed a complete basal pneumolysis The picture, taken 9 months after the operation revealed the resorption of the pneumolysis exudate, the regression of the basal pulmonary dissemination, the apical cavity closed and a matter of no little importance, the respiratory function completely regained

Basal pneumolysis gives a temporary collapse of 4 to 6 weeks only, most useful indeed to prevent postoperative aggravation of an affected lung base If therapeutically insufficient, this temporary pneumolysis can be completed or replaced by phrenic nerve crush plus pneumoperitoneum

Combined thoracoplasty and tuberculous pneumonia, example

Evidence of caseous pneumonia of the left lung was seen on the x-ray picture and a special film showed an extreme destruction of this caseous lung After preparation of phrenic nerve crush plus pneumoperitoneum, ten months later thoracoplasty was performed The efficacy of the basal pneumolysis would have been too temporary and therefore insufficient for this severe lung process The x-ray picture after the intervention

showed a remarkable collapse of the operated side. There was no further sign of active tuberculosis and the patient has been working for the last two years.

Tuberculous pneumonia does not necessarily exclude our operation

Combined thoracoplasty and the fatal tuberculous triad lung, larynx and abdomen, example

This patient had specific ulcerated larynx, specific peritonitis, and caseous pneumonia in the right upper lobe (unsuccessfully treated by phrenicotomy) and also a small cavity below the left clavicle. Tomography of the right apex showed various cavities in the caseous upper lobe and the tomogram of the left lung revealed the said small cavity. The picture, 9 months after plastic operation, showed a perfect left lung and an ideal collapse of the right one. The larynx was healed and there were no further abdominal symptoms. The patient gained nearly 28 lbs.

Tuberculosis of the lung, larynx and abdomen is not always fatal

Combined thoracoplasty and double collapse therapy, example

The x-ray film showed a right apicolysis with wax filling for a subclavicular small cavity, and a big cavity with fluid level in the left lung, as well as basal disseminations, and aftermaths of pleurisy on both diaphragms (A very bad case indeed, as we only use these wax fillings when there is no other alternative). Eleven weeks after the right apicolysis, thoracoplasty was performed on the left side. The x-ray picture shows a remarkable collapse in the upper part of the left lung and resorption of the basal disseminations, in short, inactivity of the tuberculous process.

Combined thoracoplasty as a rule does not reduce the breathing. It gives an individual aimed collapse, strictly limited to the lesions, which are nevertheless out of function. For instance, an artificial pneumothorax in the opposite side can be well supported even when an exudate arises, there is still sufficient respiratory function in the base of the plastic lung.

SUMMARY

A) *Weak Points of Thoracoplasty* Breathing capacity reduced by paradoxical movements of operated side, paradoxical retractions and expansion of the unsupported thoracic wall, consequently traction irritation of cortical lesions. Difficulties in expectoration, (reasons thereof intensified by painful coughing). Consequences: retention of sputum, increase of lesions and danger of further pulmonary and extrapulmonary spreads.

B) *Prevention of these Weak Points* Restriction of thoracoplasty to the posterior-lateral parts of the four to five upper ribs, the region which is covered by the shoulder blade. In this region paradoxical movements are thus avoided, but therapeutic effect is insufficient, therefore accessory factors of collapse therapy are necessary.

C) *The Combined Collapse Method*

1) Resection of the posterior-lateral parts of the four to five upper ribs and painting of the periosteum with a 10 per cent formalin solution (to avoid rib regeneration and to make retraction of lesions possible even later on)

2) Resection of the five to six upper intercostal nerves with the exception of the first (avoiding pain of and breathing with the anterior chest wall)

3) Pneumolysis from the first intact rib, in other words, from the fifth or sixth towards the base (sufficient in size for the luxation of the shoulder blade and to be enlarged according to the position and dimensions of the lesion)

4) Intrathoracic luxation of the shoulder blade as an osteo-muscular filling and as an effective support for the resected thoracic region

D) *Chief Characteristics of Combined Thoracoplasty* No paradoxical breathing, normal respiratory functions unrestricted, no pain, no retention of sputum, no irritations of lesions, no further tuberculous spreads, surgical shock reduced to minimum, number of cases hitherto denied active treatment, operated, arm action almost unchanged, total absence of infection, results justify method, equal advantage with eight rib thoracoplasty, key position in collapse mechanism, no obstacle for further horizontal or vertical extension of thoracoplasty

RESUMEN

A) *Defectos de la Toracoplastia* Disminución de la capacidad respiratoria por los movimientos paradójicos del lado operado, contracción y expansión paradójicas de la pared torácica sin apoyo y, por consiguiente, irritación por tracción de lesiones corticales. Dificultad de expectorar (agravada por el dolor que da la tos). Resultados: retención de esputo, aumento de las lesiones y peligro de más propagaciones pulmonares y extrapulmonares.

B) *Prevención de estos Defectos* Restricción de la toracoplastia a las partes postero-laterales de las cuatro o cinco costillas superiores, la región que está cubierta por el omoplato. Se evitan así los movimientos paradójicos de esta región, pero es insuficiente el efecto terapéutico y, por consiguiente se necesitan factores accesorios de colapsoterapia.

C) *El Método de Colapso Combinado*

1) Resección de las partes postero-laterales de las cuatro o cinco costillas superiores y aplicación al periostio de una solución de formalina al 10 por ciento (para evitar la regeneración de las costillas y para que sea posible la retracción de las lesiones, aun más tarde)

2) Resección de los cinco o seis nervios intercostales superiores con excepción del primero (lo que evita el dolor y los movimientos respiratorios de la pared torácica anterior)

3) Neumonolisis desde la primera costilla intacta, es decir, de la quinta o sexta hacia la base (de suficiente tamaño para la luxación del omoplato y agrandada de acuerdo con la ubicación y dimensiones de la lesión)

4) Luxación intratorácica del omoplato como un relleno osteomuscular y para el apoyo efectivo de la región torácica reseada

D) *Características Principales de la Toracoplastia Combinada*
Ausencia de la respiración paradójica, ninguna restricción de las funciones respiratorias normales, ningún dolor, ni retención de esputo, ni irritación de las lesiones, no más propagaciones tuberculosas, reducción al mínimo del choque quirúrgico, el número de casos operados, a los que hasta ahora se les había negado el tratamiento activo, casi ninguna alteración de los movimientos del brazo, completa ausencia de infección, los resultados justifican el método, tiene las mismas ventajas que una toracoplastia de ocho costillas, la posición de clave en el mecanismo de colapso, ningún obstáculo a la subsiguiente extensión horizontal o vertical de la toracoplastia

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DISCUSSION

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I had the privilege of following up Dr Maurer's first operation by this new method, done in 1940 on one of my patients

The operation described today has evolved from the fundamental idea of making a limited 4 to 5 rib thoracoplasty with bedding in of the scapula, with the dual object of achieving an optimal collapse and at the same time preserving good lung tissue Then, the 1st stage was started from the lowermost ribs and a limited extrapleural pocket established in which the lower angle of the scapula was inserted in front of the remaining ribs

Today Dr Maurer has sensibly changed his operative technic and widened the scope of indications to a great number of cases, suitable for present standard thoracoplasty procedures He now performs an intercostal neurectomy on nerves corresponding to the resected ribs, with the exception of the 1st nerve, thus immobilizing the upper chest wall and encouraging trophic changes in the remaining long anterior rib stumps whose periosteal are shelled off and painted with 10 per cent formalin At the same time an extrapleural pocket is established below the decostalized chest parietles to degrees varying with the extent and location of

the pulmonary lesions. This in turn tends to cause a concentric relaxation of the lung during the postoperative period by the collection of serum and air in the pocket that is allowed to absorb spontaneously.

The avoidance of extensive anterior chest wall decostalization and diminution of pain by neurectomy will contribute sensibly towards a less stormy and less complicating postoperative course. But, I do not think this operation can replace the standard thoracoplasty for the average case.

In large upper cavities and extensive old disease in the lower lobe, this operation will often be inadequate even with simultaneous phrenic nerve paralysis. One should not overlook also the lowering of ventilatory function subsequent to the immobilization of the upper chest wall. One of my cases with multiple intercostal neurectomy died from a contralateral spontaneous pneumothorax before help could reach him. The operation will find its main application, I believe, in the borderline bilateral subacute cases with lesions extending noticeably towards the base, this being a more effective collapse than the intercostal neurectomy alone. For limited upper lesions and especially in the presence of bilateral disease I have done a variant of the same operation on 15 patients since 1941, representing about 8 per cent of all thoracoplasties done. Longer pieces of upper ribs are removed, with an extrafacial apicolysis if indicated. Usually the 5 upper ribs are resected and neurectomy done on the last decostalized intercostal zone and the one immediately below it. The bedding in of the lower angle of the scapula is done in preference to scapulectomy, as it might contribute to the collapse of the frequently affected lower lobe apex, while the accompanying extrapleural pocket is accommodated in extent, usually limited, to the minor lesions tending to extend downward. When these lesions are more important, it is preferred to resect more ribs. Most of these 15 patients had major bilateral collapse operations. In all cases, the cavities were mechanically closed.

12 apparently cured and arrested

2 quiescent

1 died from massive contralateral hemorrhage 3 years subsequently

Aesthetic results were good. No deformity, one questionable scoliosis, 2 cases complain of little pain. Arm function is good in all patients.

This variation of thoracoplasty developed by Dr. Maurer is a noteworthy addition to our armamentarium of collapse therapy methods. It will find its application in a limited number of properly chosen cases.

Cardiospasm with Associated Pulmonary Disease

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A recent report by Rothstein and Pirkle¹ calls attention to cardiospasm as a condition predisposing to the aspiration of foreign material into the lungs. They report a case of subacute pulmonary disease in a woman with cardiospasm and refer to a few other reports in the literature. Their patient had acid fast bacilli found on culture of sputum and these were considered not to be tubercle bacilli. They quote three cases from the literature in all of which acid fast bacilli other than the tubercle bacillus had been cultured from the sputum in the presence of subacute or chronic disease of the lung associated with cardiospasm.

On the basis of two cases from the literature and their own case they suggest the syndrome may be radiologically recognizable ("Bilateral upper lobe dense infiltrations with highlights, associated with widening to the right of the mediastinal shadow. The pulmonary lesion is found chiefly at the bases of the upper lobes and so reaches down farther on the left. Coarse infiltration may be present in the lower lung fields")

CASE REPORT

Mrs. C., age 51 in 1946. This woman first developed symptoms of cardiospasm in 1919 and had very severe symptoms, which have continued with diminishing frequency and severity. She had pneumonia first in 1918, with influenza. In 1933, she suffered a severe illness diagnosed without x-ray, as pneumonia with lung abscess and in 1937, had an acute pneumonic illness which failed to resolve. She was investigated in a sanatorium in 1938 and was told she was tuberculous and advised to return to the sanatorium. As a result of this advice she consulted the writer who gave her his opinion that the disease was a nontuberculous pulmonary fibrosis but without recognition at that time of its relation to cardiospasm.

At the present time she has little cough and scanty sputum and the radiological appearances are illustrated. Acid fast bacilli have not been found. In the last five years rheumatoid arthritis has developed and led to permanent invalidism.

This case is presented as a further example of fibrosing pneumonitis associated with cardiospasm and thought related to the aspiration of foreign material overflowing into the trachea from the oesophagus as a result of the cardiospasm.

SUMMARY

A case is reported in which cardiospasm is associated with chronic pulmonary disease and in which the chest x-ray has a characteristic appearance. The literature contains reports of similar cases. The pulmonary disease is thought to be caused by aspiration of contents from the dilated oesophagus.

RESUMEN

Se informa sobre un caso de cardiospasm asociado con enfermedad pulmonar crónica en el que la radiografía del tórax reveló un aspecto característico. Se encuentran informes semejantes en la literatura. Se cree que la aspiración del contenido del esófago ensanchado causa la enfermedad pulmonar.

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FIGURE 1



FIGURE 2

FIGURE 1 Showing the chronic pulmonary infiltration, and the line indicating the position of the oesophagus curving downwards and inwards from the left apex —FIGURE 2 Showing the barium-filled oesophagus

Bronchial Adenoma

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Benign bronchial adenoma was originally identified from necropsy material by Mueller¹ in 1882. Before the advent of bronchoscopy such a tumor was only recognized, if at all, at the autopsy table. Even today these tumors are frequently mistaken by clinicians for either carcinoma or pulmonary tuberculosis.

Peterson² in 1936 was able to collect but 43 cases from the literature. Bronchial adenomata are not however as uncommon as these figures might indicate. Recheck of the literature through 1946, a total of 278 cases can be positively identified. Interestingly 235 of these cases have been reported in the last decade, i.e., since 1936. Relatively large series have been reported by Foster-Carter³ 22, Clerk and Bucher⁴ 35, Jackson and Konzelman⁵ 20, and Moersch and Tinney⁶ 38.

Of all benign intrabronchial tumors, the adenoma is by far the most common. Other benign intraluminal growths which may occur include polyp, fibroma, chondroma, lipoma, papilloma, lymphoma, thyroid adenoma and mixed tumor.

History In most instances the patient tells of repeated attacks of cough associated with chills and fever.

Symptoms Hemoptysis is the most startling symptom. Hemorrhage is apt to occur suddenly during a coughing seizure. Bleeding is dramatic in its suddenness and severity, though it usually ceases as suddenly as it appears. Cough is apt to be persistent and unproductive. Temperature is often secondary to bronchitis or pneumonitis due to temporary or permanent blockage.

Physical findings Physical findings depend on the proportionate air blockage by the tumor in the lumen of the affected bronchus (Fig. 1). Three distinct stages may be classified.

Stage I The tumefaction is small and does not obstruct the airway. Physical findings are entirely negative at this time.

Stage II The tumor all but blocks the bronchial lumen. Air is sucked past the growth and is trapped distally due to the fact that the inspiratory stroke of the diaphragm is more powerful than the expiratory thrust. The result is an emphysema limited to the particular locked air cells. Symptoms often consist of an asthmatic stridor with prolonged expiratory phase.

Stage III The tumor now occludes and blocks the bronchial lumen. Air previously trapped in the distended alveoli is quickly

taken up by the circulating blood with collapse of these previously distended alveoli. The findings are those of an atelectatic lung segment. Here complications are apt to confuse the findings. Pneumonia, pleurisy with effusion, lung abscess are the complications most frequently encountered.

As a rule, these people are not seen before the stage of atelectasis. X-ray film will confirm the physical findings. Proof of the causative factor can best be obtained by bronchography or laminography.

Differential Diagnosis Bronchial adenomata usually occur in young adults. With repeated attacks of upper respiratory infection and particularly with hemoptysis the tendency is to consider the case one of pulmonary tuberculosis even though no tubercle bacilli are recovered from sputum or gastric washings.

As there are a number of striking differences between benign adenoma and bronchogenic carcinoma, a table is presented listing their differences.

Diagnosis These benign polypoid tumors usually arise in the trachea or in one of the larger primary bronchi which can be reached by the bronchoscopist. The adenoma is characteristic as it appears through the bronchoscope. It is a tense, deeply red tumor which is usually covered with a glary mucus. This mucus reflects the light resulting in glistening high lights. On wiping

Bronchial Adenoma	Bronchogenic carcinoma
Infrequent—2 cases admitted to Brooklyn Cancer Institute in 10 years	Becoming more frequent 273 cases admitted to Brooklyn Cancer Institute in 10 years
Occurs in young adults 20-30 years of age	Occurs in older adults 50-65 years of age
60 per cent in females (reported cases)	99 per cent in males our experience in reported cases
Hemoptysis is apt to be severe and repeated	Hemoptysis is only a secondary phenomenon. When bleeding occurs is usually not copious
History is that of repeated upper respiratory infection with recovery followed by re-infection. Patients live for many years. Death when it occurs is due to complications. Pain is rare.	History is that of rapid downhill course without interval of improvement. Patients usually die within one year of onset of their symptoms. Pain is frequently the outstanding symptom and is without respite.
Metastases do not occur	Metastases are the rule
Bronchoscope—Carina is sharp—tumor appearance tense, glistening, bleeds on touch. Involved bronchus is not fixed.	Bronchoscope—Carina is apt to be blunted—tumor appears granular, is less engorged. Affected bronchus is fixed.
Pathology—cells are of uniform size, occur in nests, mitoses are absent, stroma is highly vascular.	Pathology—varies according to type. Cells vary in appearance, mitoses are frequent.

or touching this tumor it is apt to bleed profusely Proof of diagnosis must be based on biopsy section

Its histologic detail is characteristic the cells are of uniform small size, they occur in nests within a highly vascular stroma Motile figures are rarely if ever present With chronicity cartilage and bone and even bone marrow may develop within this tumor

But two cases of benign bronchial adenoma have been admitted to the Brooklyn Cancer Institute in the past ten years In this same interval some 272 cases of bronchogenic carcinoma have been admitted, or one case of benign adenoma to every 136 cases of bronchogenic carcinoma These two cases are reported in detail because both had adenomata involving other organs which produced complications in their clinical course The presence of multiple adenomata in both these patients would bring up the concept of a possible inherited weakness in these individuals' ectodermal structures

CASE REPORTS

H B is an adolescent woman of Jewish parentage, 17 years of age who in April 1937 was transferred to the Brooklyn Cancer Institute from a neighboring hospital She stated that a month previously she had been hospitalized because of cough and high fever She could remember having had similar attacks of cough and fever over the previous 2 years On examination there was dullness with diminished breath sounds in the lower right thorax. Instillation of iodized oil confirmed an obstruction in the bronchial branch to the right lower lobe (Fig 2) A previous bronchoscopic biopsy had been erroneously reported as "bronchogenic carcinoma "

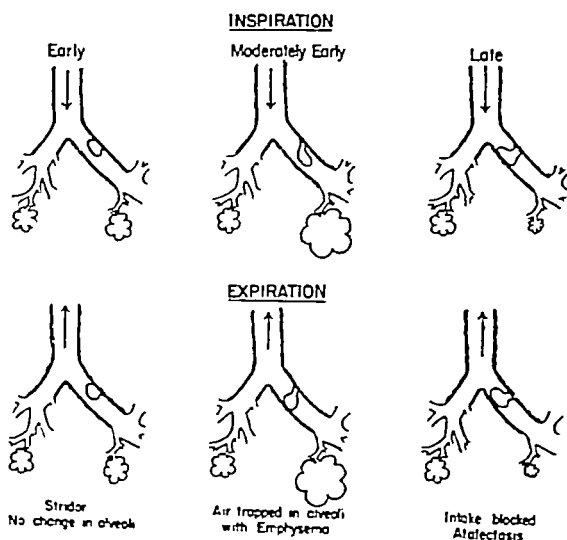


Figure 1 Schematic drawing to demonstrate effect of progressive enlargement of the adenoma on the alveolar structures distally

She was rebronchoscope and the diagnosis of benign bronchial adenoma established (Fig 3) Efforts were made to destroy the adenoma by endoscopic fulguration Following an acute flareup of the pneumonic infection, she developed an encapsulated empyema This was drained by resecting a rib In spite of this, a lung abscess developed behind the obstructed bronchus After a prolonged convalescence of 6 months she was discharged from the Brooklyn Cancer Institute as improved

February 1938, one year after her first hospitalization, she was re-admitted At this time, further attempt was made to drain the lung



FIGURE 2



FIGURE 4



FIGURE 3

Fig 2 H.B Iodized oil appears as ring at the site of adenoma plugging the secondary bronchus to the lower right lobe The atelectatic lower lobe overlies the diaphragm

Fig 3 H B Benign bronchial adenoma Nests of small cells of uniform appearance in a highly vascular stroma

Fig 4 H.B Appearance of chest after thoracoplasty and removal of lower and middle lobes Note the extensive scarring with incomplete expansion of the upper lobe into the lower thorax and appearance of a large residual abscess cavity

abscess and two large partially encapsulated empyema accumulations. Radiographs demonstrated extensive bronchiectatic cavitation in the diseased lung distal to the plugged bronchus. Clubbing of her fingertips became evident. She was given several small transfusions and by April 1938 the bronchial fistula seemed to be healing and she was discharged again as improved.

In June 1939 (over 2 years after her first hospitalization), she was admitted into another hospital. There an unsuccessful attempt was made to remove the right lower lobe. It was not till August of that year that the surgeon was able successfully to remove the diseased middle and lower lobes (Fig 3). After a prolonged convalescence she gained weight and appeared symptomless, except for a persistent draining chest sinus which did not close until 1940.



FIGURE 5



FIGURE 6

Figure 5 H.B. Appearance in 1937 before bronchial or pituitary adenomata appeared—*Figure 6* H.B. Taken in 1946 showing facial changes due to pituitary adenoma

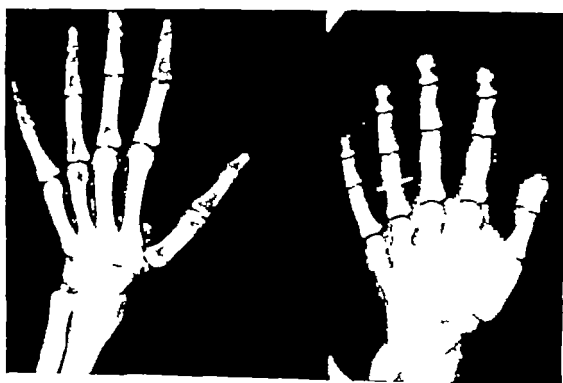


Figure 7 Hand (left) before flaring of tufts and coarsening of bone structure and (right) same following changes due to influence of pituitary adenoma

In 1945 this sinus re-opened and in June 1946 her cough returned and she again began to raise large amounts of purulent, foul smelling sputum (Fig 4) A large cavity had formed in the retained right upper lobe These symptoms were partially controlled by large doses of penicillin

In 1941 she noticed that her lower teeth were spreading, and that her nose and chin were apparently becoming more prominent, her skin was assuming a coarsened texture and abnormal hair appeared on her forearms and over the pubic area (Figs 5 and 6) One day she accused a shoe salesman of having given her shoes of too small a size, she also noticed that her gloves were too tight to wear (Fig 7) Her menses ceased It was, however, not until 3 years later that examination of her



Figure 8 H.B No 608 Ballooned out sella turcica due to a large eosinophilic granuloma



Figure 9 H.B Pituitary adenoma

visual fields demonstrated a bitemporal hemianopsia X-ray film revealed a ballooning out of her sella turcica (Fig 8) With the facts listed above, there is little doubt that this patient also had an eosinophilic adenoma of the pituitary gland (Fig 9)

C H a 50 year old Polish male was first admitted into the Brooklyn Cancer Institute in 1938 He stated that for 22 years (since 1916) he had had "bouts of lung trouble" These attacks consisted of chills, fever with cough and occasionally he coughed up large amounts of bright red blood Of late, he noticed that he is increasingly "short of breath"

He had been treated in a number of hospitals for pneumonia Finally



Figure 10 C.H. Large wedged atelectatic mass to the right of the heart—right lower lobe



Figure 11 C.H. Kidney lesion Benign papillary adenoma

a diagnosis of pulmonary tuberculosis was arrived at He was sent to a hospital for the treatment of tuberculosis Later he sought treatment at a tuberculosis sanatorium in Colorado Since his return from Colorado, he again had several bouts of "pneumonia" During his last hospitalization, a large cystic tumor of his left kidney was discovered and removed It was during his convalescence from this procedure that he was transferred to the Brooklyn Cancer Institute

On admission, his temperature fluctuated widely for several days, then gradually subsided Physical findings were dullness with absent breath sounds but increased vocal fremitus throughout the lower half of the right thorax The liver, moderately tender could just be palpated His fingers were clubbed No tubercle bacilli or actinomycosis rods were recovered on repeated examinations of his sputum

X-ray film (Fig 10), demonstrated a triangular opacity extending laterally from the right border of the heart to the costophrenic sinus This was proven to be an atelectatic right lower lobe A large amount of pus which kept welling out of the lower right main bronchus made the bronchoscopic examination difficult After aspiration a tense tumor mass was sighted, this bled profusely on touching A biopsy was taken and reported as bronchial adenoma

Treatment The endobronchial neoplasm was electrocoagulated on several occasions Each attempt was followed by excessive bleeding Three months after admission (June 29, 1938) he died as a result of a profuse pulmonary hemorrhage

In 1937 he had had a melon sized cystic left kidney removed, section



Figure 12 C.H Right lung demonstrating adenoma filling lower right main bronchus

of this kidney was never obtained At necropsy a discrete cortical adenoma was discovered in the remaining kidney (Fig 11)

Necropsy A globular yellow white tumor mass plugs the lumen of the lower right main bronchus This is attached to the bronchial wall by a broad base Its surface appears necrotic (fulguration) The right main bronchus is partly filled with recent blood clot (Fig 12)

Microscopic examination The tumor is composed of groups of cells in alveolar, papillary and row form (Fig 13) The individual cells are uniform in appearance, have a moderate amount of pink cytoplasm, are cuboidal or polygonal Nuclei are uniform in appearance, small, round or ovoid and vesicular, occasionally hyperchromatic There are no mitotic figures There is absence of any inflammatory cellular infiltration The mass is completely surrounded by a wall of fibrous tissue In spots, a regular dense bony structure has been laid down This has occurred in previous dense fibrous bands A suggestive marrow is occasionally present containing numerous dilated blood spaces (Fig 14) The site of diffuse hemorrhage has undergone coagulation necrosis (post operative?)

SUMMARY

The literature of benign bronchial adenoma is reviewed

This tumor may be mistaken for pulmonary tuberculosis or bronchogenic carcinoma

Treatment is endoscopic fulguration or lobectomy

Two cases of bronchial adenoma are reported, interestingly each had adenomatous involvement of other organs



FIGURE 13

FIGURE 14

Figure 13 C.H Lung tumor Typical nests of tumor cells in a rather scant poorly cellular stroma—Figure 14 C.H Lung tumor Formation of bone and marrow within the tumor

RESUMEN

Se repasa la literatura relativa al adenoma bronquial benigno

Se puede confundir este tumor con la tuberculosis o el carcinoma broncogénico

El tratamiento consiste de fulguración endoscópica o lobectomía

Se informa sobre dos casos de adenoma bronquial en los que se notó con interés que ambos tenían invasiones adenomatosas de otros órganos

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Bronchiectasis in Children*

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Since the classic description of the bronchiectasis by Laennec in 1819, our knowledge about dilatation of the bronchial tree has greatly increased through

- 1) Anatomopathological studies
- 2) Bronchographic studies
- 3) Endoscopy
- 4) Surgical treatment

Modern bronchographic technic has made easy the early discovery of bronchiectasis. It is also applicable routinely during the first years of life, permitting modern surgical treatment, with very little risk and excellent results even in extensive bilateral cases (Overholt and Langer).¹ Unfortunately, we still too frequently see children harboring bronchiectasis for many years without diagnosis and dying of some broncopulmonary complication.

Reviewing the official mortality statistics in the city of Córdoba, we see that from 1930 to 1940 no case of death caused by bronchiectasis in children under 15 years of age, was reported. No case was reported under the label of chronic bronchitis or non-specified bronchitis in 1930. In 1935, 4 cases were reported, all of them under 9 years of age (2 chronic and 2 nonspecified), in 1940, 3 cases were reported, all of them under 1 year of age (1 chronic and 2 nonspecified). This lack of figures relative to mortality due to bronchiectasis in children shows obviously, how the diagnosis of this disease in the medical practice is overlooked, even now.

In our city, the third largest in the Argentine, with a population of 325,000 inhabitants, its infant mortality due to pulmonary disease is 19 per cent of the general mortality from 0-1 year of age, 20.4 per cent of the general mortality from 1-4 years of age, 8.8 per cent of the general mortality from 5-9 years of age.

In the Children's Hospital of Córdoba during the last 10 years, of 27,636 patients, only 60 cases were hospitalized on account of bronchiectasis, that is 0.2 per cent.

It is estimated that in children, bronchiectasis represents about 5 per cent of all diseases. Bonniot,² reports that one third of the

*Presented at the 13th Annual Meeting of the American College of Chest Physicians Atlantic City, 1947.

children with bronchiectasis die in 2-3 years after acquiring the disease Head³ states that persons who have developed bronchiectasis during childhood live only to 40 years of age Perry and King,⁴ studying 96 patients with bronchiectasis in the first decade of life, noted that 65 per cent die within 20 years and 90 per cent within 30 years

Bronchiectasis in Pediatrics

The study of the disease in adults shows the frequency of early symptoms during childhood, an age in which a number of illnesses complicate bronchial changes (especially whooping cough) Laennec said that out of every four bronchiectasis in the adult, three had their origin in childhood According to other reports, symptoms of bronchiectasis in adults is traceable to the first decade of life in 27 per cent and to the first two decades in 57 per cent

In the first decades of life, the symptoms of bronchiectasis are intermittent, and often masquerading as acute lung diseases, especially pneumonia We always remember the old teaching of Czerny⁵ who said, "that every child that has repeated acute pneumonia with the same localization of the lesion, should make the physician think of bronchiectasis"

The responsibility of the pediatrician is greater than that of the general practitioner, because he has the primary responsibility in the early recognition of the disease and stands in "the first line of defense" as Brennemann⁶ said The diagnosis can be frequently suspected from the history of the patient and from the physical examination, however a precise diagnosis can only be made as we mentioned before, by bronchographic studies

Classification of Bronchiectasis in Children

Bronchiectasis is classified as *congenital* and *acquired* The congenital type was considered till not many years ago, as the most frequent, but new systematic investigation of the bronchial tree shows now that acquired bronchial changes are the most common during the first decade of life *Congenital* bronchiectasis is produced by a lack of development in the embryonic stage that Castex⁷ calls "alveolo-agenesic-bronchiectasis"

Recent researches attribute these congenital malformations to virus diseases, acquired by the mother during the first 3 months of pregnancy (Erickson, Conte and his associates^{8,9}) According to the experimental work of Warkany,¹⁰ the malformation in the embryo may be due to a lack of vitamin A or B Kartagener¹¹ published his observations on bronchiectasis in "Situs viscerum inversus" and describe what is known as the "triad of Karta-

gener" that is, the coexistence of bronchiectasis, sinusitis and congenital dextrocardia

Pathogenesis of Bronchiectasis in Children

Acquired bronchiectasis may result from the following diseases
1) Bronchial infections, especially whooping cough 2) Measles
3) Chronic pneumonitis, sclerosis and lung abscesses 4) Foreign bodies 5) Atelectasis 6) Tuberculosis 7) Infection of tonsils and paranasal sinuses 8) Allergic catarrhs

Especially in children under 5 years of age, after acute or subacute bronchitis, there is a change in the bronchial mucous membrane, with a thickening of it. These changes are also observed after whooping cough, measles and repeated gripes. Following these changes of the mucous membrane, alterations in the basal stratum of the bronchial wall appear, becoming chronic and developing into definitive bronchiectasis. Transitory bronchial enlargement during whooping cough may be due to muscular paralysis of the bronchus in the neighboring zones of the inflamed mucosa. We must remember that histologically, the small bronchi are principally formed by muscles that occupy the greatest part of the bronchial wall and contribute with their tonus to the preservation of the normal bronchial form.

Roentgenologic studies of the chest are of great value in discovering atelectasis in some segments of the lung. Atelectasis sometimes precedes, coexists or follows a bronchiectasis and it may be due to bronchial obstruction produced by infections (Anspach¹²).

It is important to bear in mind that bronchiectasis involving an entire lobe may be produced by foreign bodies. We shall briefly describe the following cases.

A girl 11 years of age came to us with a bronchopulmonary disease which had begun 5 years before. During the later months, she had repeated hemoptyses. She came to the Children's Dispensary of the Instituto de Fisiología de Córdoba (Director Prof. G. Sayago) because her private physician thought of tuberculosis. X-ray film showed a shadow in the right cardiophrenic angle.

We ruled out tuberculosis because the tuberculin reaction was negative. A lateral x-ray film showed very clearly the presence of a screw in the basal segment of the right lower lobe. Neither the mother nor the child knew of the presence of a screw in the lung. After a careful inquiry they both remembered that 5 years before, while the girl had whooping cough she played with a box of screws and nails. After two bronchoscopic sessions the foreign body was removed. It was a rusty screw one inch long (Figs 1 and 2).

Hemoptysis stopped but the cough persisted. A bronchogram was performed showing very clearly bronchiectatic changes in the pulmonary segment obstructed by the screw.



FIGURE 3



FIGURE 2

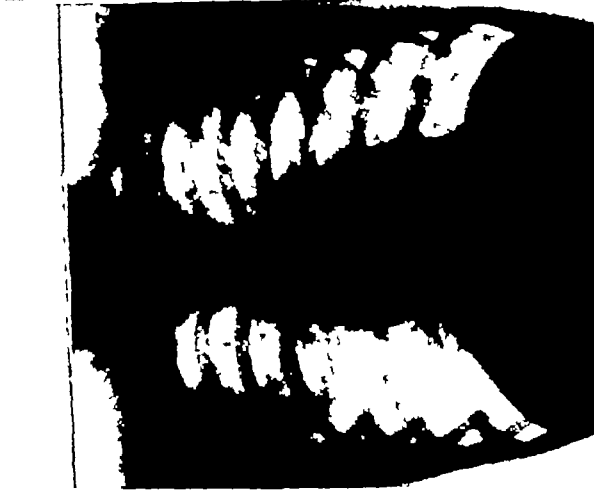


FIGURE 1

Mycotic infection as a primary disease in the lung may also produce bronchiectasis

We had such a case a child, 5 years of age, came to the Children's Hospital (Prof J M Valdes) in very poor condition She had fever, cough and expectoration for eight months An x-ray film showed almost complete atelectasis of the entire right lung Bronchoscopy revealed abundant secretions coming from the right stem bronchus which was narrowed, unfortunately due to his poor condition bronchogram was not done The child died soon after admission Post mortem studies revealed typical fungus colony, with bronchiectasis and multiple abscesses (Fig 4)

Bronchiectasis and Atelectasis in Children

Huizinga¹³ of Holland, reporting on 40 cases of bronchiectasis in children, emphasized the importance of atelectasis in producing bronchial alterations Clinical examinations reveal evidence of a condensed lung Fluoroscopic or roentgenographic studies will show a triangular shadow, corresponding to an atelectatic segment Anspach, Ellis, Brennemann, Holinger^{6 12 14 15} and others have published several papers dealing with the relationship between bronchiectasis, collapsed lung (shrunken lung) and the triangular shadow seen on the x-ray film Anspach¹² examining thousands of children's x-ray pictures of the chest found nearly 1 per cent of triangular shadows

We wish to call attention to the seriousness of atelectasis, especially during the first two years of life, not only because of possible bronchiectasis but also because of secondary infections that may occur Sometimes the new born suffers from atelectasis, which is not noticeable and which may be the cause of a partly shrunken lung During the first year of life, thickening of bron-



FIGURE 4



FIGURE 7



FIGURE 6



FIGURE 5

chial secretions may sometimes cause obstruction of the small bronchi. This obstruction of the air passage reduces the ingress of air until it causes atelectasis.

We feel that all the broncopulmonary diseases should be followed very carefully by x-ray studies, in different projections. Many small opaque triangular areas can be easily overlooked when the film is taken only in one projection. We pediatricians are responsible to a certain extent for the development of bronchiectasis if we fail to make an accurate diagnosis.

In our practice we have found certain simple measures valuable in preventing or curing atelectasis. We resort to medication that liquify the bronchial secretion, postural drainage, frequent changes of position, naso-tracheal aspiration, and as a last resort bronchoscopic aspiration. In new borns we find that the results obtained by the use of carbogen (95 per cent O_2 + 5 per cent CO_2) in aerating the lung are very gratifying.

We shall now show the outcome of two cases of atelectasis developed in early life, not diagnosed until complications developed.

A girl, 9 years old, had whooping cough when five years of age and measles at the age of six. For the last 7 years she complained of productive cough. X-ray picture showed a basal triangular shadow beneath the cardiac area (Fig 5). Bronchographic studies were not done at that time. Operative specimen revealed a small fibrotic and shrunken lower lobe with bronchiectatic changes (Children's Hospital, Prof J. M. Valdes).

A girl, 6 years of age, had bronchitis when 6 months old and at three years of age had whooping cough. Plain x-ray picture (taken when she came to the Hospital, Surgical Department, Prof Dr J. M. Allende), showed an opaque zone in the lower half of right lung with a marked displacement of the heart towards the affected side (Fig 6). The bronchogram revealed saccular bronchiectasis in the right upper lobe (Fig 7). The parents refused surgical intervention.

SUMMARY AND CONCLUSION

- 1) *Atelectasis* is frequent in childhood and must be considered as an important cause of bronchiectasis.
- 2) It is the duty of the pediatrician to resort to all the diagnostic means at our disposal to make an early diagnosis.
- 3) *Bronchiectasis* in the adult is a process which frequently originates in the first or second year of infancy.
- 4) Bronchial changes can take place in whooping cough and measles. These changes may not be permanent, and in this pre-bronchiectatic stage, medical treatment can be sometimes successful.
- 5) If medical treatment fails, bronchiectasis becomes defin-

ately established and irreversible, only by surgical treatment can a permanent cure be obtained

6) Surgical treatment must not be postponed Children tolerate the intervention better than adults

7) Our experience deals with 10 cases, 4 boys and 6 girls, between 4 and 13 years of age, 7 were operated upon, and 3 refused operation Of the 7 operated cases, bronchiectasis was present in 4 in the left lower lobe and in 3 in the right lower lobe They all made complete recovery, one of the nonoperated patients died One of the cases showed the triad of Kartagener In all cases the bronchiectasis was localized in the lower lobe, with exception of one that had bronchiectasis in the right upper lobe, and in one, the bronchiectasis of the left lower lobe was associated with bronchiectasis of the lingula

RESUMEN Y CONCLUSION

1) La *atelectasia* es frecuente en la niñez y debe ser considerada como una causa importante de bronquiectasia

2) El especialista en pediatría tiene el deber de valerse de todos los medios de diagnosticar a su disposición a fin de hacer un diagnóstico temprano

3) La *bronquiectasia* en el adulto es un proceso que frecuentemente se origina en el primero o segundo año de la infancia

4) En la tos ferina y la alfombrilla pueden ocurrir alteraciones bronquiales que no sean permanentes y en esta etapa pre-bronquiectásica el tratamiento médico es a veces eficaz

5) Si fracasa el tratamiento médico, la bronquiectasia queda establecida definitivamente y es irreversible, solamente mediante el tratamiento quirurgico puede obtenerse una curación permanente

6) No debe aplazarse el tratamiento quirurgico Los niños soportan la intervención mejor que los adultos

7) Nuestra experiencia incluye 10 casos 4 niños y 6 niñas, de 4 a 13 años de edad Se operó a 7, tres rehusaron la operación De los 7 casos operados la bronquiectasia afectaba el lóbulo inferior izquierdo en 4, y el lóbulo inferior derecho en 3 Todos los operados se repusieron por completo, mientras que uno de los pacientes no operados murió Uno de los casos manifestó la terna de Kartagener En todos los casos la bronquiectasia estaba localizada en el lóbulo inferior, con la excepción de uno que tenía bronquiectasia en el lóbulo superior derecho y otro en el que la bronquiectasia del lóbulo inferior izquierdo estaba asociada con bronquiectasia del proceso lingual

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Present Status of Streptomycin In Tuberculosis

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Streptomycin has become established as a valuable weapon in the therapy of tuberculous infections. Tuberculosis is a protein disease, its symptomatology and prognosis variable. As is well known, spontaneous healing may occur without benefit of presently accepted therapeutic measures. Hence it is readily apparent that the final evaluation of any tuberculo-chemotherapeutic agent will be possible only after long and arduous experimental and clinical study.

Nearly four and one-half years have passed since streptomycin was first reported by Schatz, Bugie and Waksman.¹ This antibacterial agent is produced by certain strains of the actinomycete, *Streptomyces griseus*. It possesses selective activity against a variety of pathogenic organisms in vitro, among them human and bovine strains of *Mycobacterium tuberculosis*.

Within a year following the discovery of streptomycin, Feldman and Hinshaw^{2,3} had found that the antibiotic exhibits a unique suppressive action against tuberculous infections, both experimentally and clinically. This work has been confirmed by many other investigators. Following the early investigations at the Mayo Clinic and Mineral Springs Sanatorium, various Federal agencies in cooperation with the drug companies producing streptomycin instituted a centralized program of experimental and clinical research. As a consequence, in the past three years many hundreds of carefully selected cases of various forms of tuberculosis have been treated, and many problems inherent in the chemotherapeutic assault on tuberculosis have been clarified. But the complete role of streptomycin in the treatment of tuberculosis has yet to be determined.

Streptomycin in Experimental Tuberculosis

The antibiotic action of streptomycin in experimentally induced tuberculosis in guinea pigs has been well established.

In 1944, Feldman and Hinshaw demonstrated the effectiveness of streptomycin in vivo. In a series of extensive experiments⁴ they

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proved that streptomycin has the striking ability, not only to inhibit the progress of tuberculous lesions, but also to reverse the potentially fatal course of experimentally induced tuberculosis in the highly susceptible guinea pig. The drug was found to have a relatively low toxicity.

In the fall of 1944, it was felt that cautious use of streptomycin was justified in human beings. Cases selected for the first clinical trials were those in which the prognosis was considered hopeless, such as miliary and meningeal forms of tuberculosis, and nearly terminal pulmonary cases. Careful pharmacological studies for toxic manifestations were made on these patients.⁵ The encouraging clinical results obtained and the relatively low toxicity which occurred soon made it apparent that the drug could be used in patients with a more favorable prognosis. A summary of observation on 100 cases of human tuberculosis treated with streptomycin was published in November, 1946.⁶

Clinical Use of Streptomycin

Pulmonary Tuberculosis In the chemotherapy of pulmonary tuberculosis, it is paramount that there be an intensive evaluation of the individual case prior to commencing treatment. At present, due to the phenomenon of acquired bacterial resistance, it is felt that streptomycin cannot be expected to exhibit its suppressive action for more than one period of treatment. Caution, then, with regard to the long term management of the patient is imperative, because there may be greater need for the use of streptomycin at a future time. Experience to date indicates that the drug is not as effective in many cases of pulmonary tuberculosis as in some other forms of the disease.

The maximum therapeutic benefit of streptomycin in pulmonary tuberculosis occurs in pneumonic and early exudative lesions. There may be some degree of improvement in proliferative lesions, but the pathologic tissue changes occurring in fibrocaseous and fibrocavernous lesions are often irreversible. In minimal pulmonary tuberculosis streptomycin therapy is seldom indicated.

With some exceptions, the selection of cases to receive streptomycin is best determined by roentgenographic and clinical observation over a period of at least several weeks. Results will be more nearly comparable when there has been an adequate trial of rest with or without other therapeutic procedures. A lesion that has been progressive or has remained stationary with previous therapy may respond favorably to the retardative action of streptomycin, permitting the natural defense mechanisms of the host to accelerate the reparative processes.

The Streptomycin Committee of the Veterans Administration⁷

reported in December 1947, the results of 223 cases of pulmonary tuberculosis treated with the drug under carefully controlled conditions. Of these 223 cases, 156 (70 per cent) were far advanced, 65 (29.1 per cent) were moderately advanced and 2 (0.9 per cent) were minimal. The patients were predominately white males, less than 30 years of age, and were selected because they had progressive or stationary lesions after two months of observation. They received a daily dose of 18 grams of streptomycin (0.3 grams every four hours) for 120 days. On the basis of roentgenographic changes, 85 per cent were judged as improved, 10 per cent as unchanged, and 0.5 per cent (1 case) showed progression during the period of treatment. Of 182 cavities at beginning of treatment, 47 (26 per cent) were closed or had disappeared and 67 (37 per cent) were smaller. The remainder were unchanged or larger.

In this study 195 patients were followed by serial roentgenograms for an average of 117 days after cessation of treatment. Of these 40 per cent continued to show improvement, 44 per cent remained unchanged and 16 per cent had extensions or spreads that occurred mainly within 30 days after discontinuing treatment. The authors concluded that "the case for streptomycin rests primarily on the fact that, during treatment, some degree of roentgenographic clearing occurred in 85 per cent of the lesions, of which a majority had been stable or progressive before streptomycin was instituted." They also re-emphasized the fact that streptomycin is an adjunct in the treatment of tuberculosis and superior in suitable cases to bed rest alone.

Similar results are reported by Muschenheim, McDermott, et al⁸ in their study of 43 patients, in which they used 3 grams of streptomycin in their early cases for 120 days and one gram daily in 10 cases for 42 days. They concluded that there was some measurable improvement in all of these 43 cases, as shown by roentgenographic clearing.

Results indicate that with the use of streptomycin the scope and frequency of surgical procedures in the treatment of pulmonary tuberculosis are definitely increased. Such procedures are frequently made possible by resolution of exudative lesions, especially in the contralateral lung, and by improving the patient's general condition.

In the selection of cases to receive streptomycin therapy it must be borne in mind that there exists a real hazard of the dissemination of drug-resistant organisms. When patients discharging such organisms leave a sanatorium against advice, they constitute a particularly dangerous public health menace. Experience to date indicates that drug-resistant tubercle bacilli

transferred to previously uninfected individuals will retain their resistance streptomycin probably will be of no value in the treatment of these people

Tuberculous Empyema Streptomycin appears to have little value in the treatment of well established tuberculous empyema Experience with the drug in this condition has thus far proved to be disappointing It remains to be seen whether the use of streptomycin in combination with detergents and other antibacterial agents will achieve better results

Disseminated Tuberculosis Conclusive evidence of the efficacy of streptomycin therapy is apparent in the unprecedented clinical and objective improvement which often occurs within one to three weeks in the otherwise highly fatal forms of disseminated tuberculosis Since there is no other known treatment capable of bringing about remission, treatment with streptomycin is mandatory in every case It is imperative that the disease be recognized early and the maximal tolerated doses of streptomycin be employed immediately, attempting to avoid only the more serious and permanent types of toxicity In cases of meningitis, treatment with streptomycin should be instituted whenever presumptive evidence indicates that the tubercle bacillus may be the etiological agent, without waiting for bacteriological confirmation

In tuberculous meningitis the ultimate mortality probably will not be decreased appreciably, but the remission due to streptomycin is often remarkable in degree and may persist for many months Lincoln and her co-workers⁹ report success in the treatment of tuberculous meningitis, using promizole, a sulfone compound, in addition to streptomycin administered intramuscularly and intrathecally However, her series of cases is small, treatment was begun very early in the course of the disease, and insufficient time has elapsed since termination of treatment to determine whether this combination of therapeutic agents is superior to streptomycin alone

In generalized miliary tuberculosis the probability of permanent arrest is considerably greater than in tuberculous meningitis or in disseminated tuberculosis with meningeal involvement Miliary pulmonary lesions may show improvement after only three or four weeks of treatment, and frequently such lesions are scarcely detectable roentgenographically after eight weeks of therapy They may be complete remission as observed clinically, bacteriologically, and roentgenologically

Unfortunately the remission which occurs in miliary tuberculosis is not always sustained It has been shown that streptomycin does not penetrate the substance of the brain and this may be a significant factor in cases which terminate fatally Not uncom-

monly meningeal involvement becomes manifest when the patient with miliary tuberculosis is already receiving streptomycin intramuscularly in adequate doses. The meningitic process may or may not undergo remission when intrathecal administration of streptomycin is instituted.

When disseminated tuberculosis recurs after a streptomycin-induced remission, a second course of treatment is beneficial only if the infecting organisms are still predominantly sensitive to the drug. In most cases, further treatment is of no value, or the remission effected is less striking in degree and duration than the original remission.

Other Forms of Tuberculosis Ulcerative and granulomatous lesions of the larynx and tracheobronchial tree respond to streptomycin therapy with almost uniform healing. Improvement may be noted within two weeks during therapy, and in the majority of cases healing usually occurs within six to eight weeks. Administration of the drug is effective by the intramuscular route and relatively ineffective by aerosol therapy alone.

In tuberculous lesions of the oropharynx, streptomycin has proved to be the treatment of choice. The majority of these lesions can be expected to heal completely within two to three months, with doses of one gram daily or less. In one case under our observation, a lesion of the tongue proved tuberculous by biopsy was associated with fibrocaceous pulmonary tuberculosis and positive sputum. Healing of the lesion occurred after six weeks of treatment with a dose of 0.5 gram of streptomycin given intramuscularly in one injection daily.

In tuberculous enteritis streptomycin is the treatment of choice. Cases usually respond with a marked decrease in symptoms within two weeks.

Draining cutaneous sinuses from tuberculosis of the bone, joint, cartilage, and lymph glands respond to streptomycin with rapid and consistent healing. The response in this form of tuberculosis is valuable as it affords an easily objective study of the effectiveness of streptomycin. There is a tendency in a few cases for subsequent recurrence of drainage and enlargement of lymph glands. The Veterans Hospitals have reported that closure of draining sinuses is accelerated by removal of pus and necrotic material surgically.

Tuberculosis of bone and joints appear to be retarded in some cases sufficiently to produce healing, alone or in conjunction with orthopedic surgery.¹⁰ Further study is necessary to permit conclusions as to the ultimate place of streptomycin in treatment in these conditions.

Genito-urinary tuberculosis has responded to streptomycin,

chiefly by improvement in symptoms. The drug is of value as an adjunct when surgery is indicated and is the treatment of choice when surgery is impossible, as in tuberculosis of a solitary kidney, or bilateral renal tuberculosis. Its palliative effects are pronounced and prolonged in more than 50 per cent of the lesions treated.¹¹ At the Veteran's Hospital at Bronx,¹² New York, 23 out of 32 cases of tuberculosis of the genito-urinary tract were reported as improved, but the investigators draw no conclusions as to the maintenance of improved status.

In tuberculous peritonitis, the number of cases treated with streptomycin has been small, but reports indicate that the drug has a definitely favorable effect on the course of the disease. It appears that streptomycin is the treatment of choice in such cases, combined with rest and other accepted therapy.

Tuberculous pericarditis, to date, has not responded successfully to streptomycin in the great majority of cases. This may be due to failure in starting treatment sufficiently early in the course of the disease.

The response of the various forms of skin tuberculosis to streptomycin has been variable, with a tendency toward recurrence of the lesions.

Evidence accumulated thus far would indicate that streptomycin is often beneficial in tuberculous otitis media. We believe it will prove to be an important factor in the treatment of such cases, combined with other accepted therapy.

In ocular tuberculosis, the number of cases reported to date, treated by streptomycin, is too small to permit drawing any conclusions.

Administration and Dosage

For all forms of tuberculosis except meningitis, streptomycin should be given parenterally, preferably by intramuscular or deep subcutaneous injection. In tuberculous meningitis, daily intrathecal injections of 25 to 100 milligram in addition to the intramuscular administration were previously considered imperative. However, this opinion has been challenged recently by some investigators both in the United States and in Europe. Investigations carried out at Herman Kiefer Hospital in Detroit have led the group there to believe that intrathecal injection of streptomycin has no particular value and is contra-indicated because of the severe toxic manifestations which may result from this method of administration.¹³ Undoubtedly, further clinical study will determine which of these two views is correct. In any event, early diagnosis and treatment is most essential to recovery. A minimal dosage of two grams daily, given intramuscularly, for at

least three to four months is recommended at this time for this disease

For all other forms of tuberculosis, a total dose of one gram daily for two to three months is sufficient. Some investigators are reporting good results in many cases with doses of 0.5 gram daily or less for periods of 30 to 60 days. Frequency of administration may vary from 12 to 24-hour intervals, apparently with similar results clinically. The present trend seems to be toward a single injection daily. The optimal duration of therapy will vary considerably in different cases, depending upon the time of appearance of streptomycin-resistant strains. Further investigations will undoubtedly clarify the problems of daily dosage, frequency of administration, and duration of treatment.

Toxicity Most investigators have been impressed with the relative lack of serious toxic effects from streptomycin. The potential toxicity should not be a deterrent when indication for treatment is definite.

The three chief toxic manifestations of streptomycin are (1) damage to the eighth nerve resulting in vestibular disturbance, (2) renal irritation, and (3) sensitization reactions. Vestibular disturbance is noted in the large majority of patients who receive 2 or more grams daily for extended periods of time. Dizziness and ataxia may vary in severity and in time of appearance. They may occur early or late in the course of treatment. The loss or decrease of labyrinthine function can be demonstrated by caloric stimulation tests, and this loss appears to be permanent.

Fortunately most patients can compensate for vestibular dysfunction to a remarkable extent. A number of our patients, in whom there is complete loss of vestibular function as demonstrated by caloric stimulation tests, have returned to their former occupation. Middle aged and elderly patients compensate more slowly and to a less degree than younger individuals.

The danger of deafness from treatment with streptomycin is negligible. Cases in which a partial loss of hearing has been reported have occurred only when concentration of streptomycin in the blood were excessive, due either to extremely high dosage or to renal insufficiency. In such cases hearing is restored if the drug is discontinued promptly. It is interesting to note that cases of permanent deafness which have been reported have occurred only in patients with tuberculosis meningitis.

Cylindruria and low grade albuminuria occur not infrequently during treatment with streptomycin. It is now accepted that permanent renal damage referable to streptomycin has occurred only when there was evidence of renal impairment before treatment.

Sensitization reactions may occur occasionally after treatment of one to three weeks, with manifestations of chills, fever, nausea, and skin rash. In such cases the drug should be discontinued until these symptoms have subsided. Treatment may then be resumed with minute doses of 0.1 gram daily, gradually increasing the dosage over a period of two to four weeks until the desired daily dosage is reached.

Isolated cases of serious toxic effects from streptomycin have been reported by the army, navy, and Veteran's Administration,¹⁴ including three cases of exfoliative dermatitis, one case of agranulocytosis, and two cases of aplastic anemia in which the drug is suspected of being a factor. Fortunately such cases are rare.

The toxicity of streptomycin parallels the dosage and, to a lesser extent, the duration of treatment. Among patients receiving two grams daily for three to four months, mild to severe vestibular disturbance as determined by caloric stimulation tests, can be anticipated in 90 per cent or more. In our experience, when doses of one gram daily for similar periods are used, the toxic manifestations with reference to the vestibular mechanism are markedly reduced. Approximately one half of these patients revealed no vestibular dysfunction by caloric stimulation tests.

Bacterial Resistance The phenomenon of bacterial resistance to streptomycin is the major limitation to the use of this drug in the treatment of tuberculosis. Evidence has accumulated to indicate that in approximately three-fourths of the cases the bacterial population is predominantly resistant after two to four months of treatment. In most cases this resistance has proved to be permanent. Studies have shown that resistance may occur as early as one month after treatment is started. The importance of this problem is obvious, since further treatment with streptomycin has proven to be ineffective when the infecting organisms are drug-resistant.

It is hoped that some method will be found to prevent or delay the occurrence of resistance. Perhaps some other anti-tuberculosis agent may be discovered which is clinically applicable and can be used alone or in combination with streptomycin to achieve this end.

SUMMARY

Streptomycin is now accepted as a valuable weapon in the treatment of tuberculosis. Like other valuable drugs, it has its assets and limitations. It can not be considered a substitute for sanatorium care and other well established measures such as collapse therapy. It is a "must" in the treatment of (1) military tuberculosis, (2) tuberculous meningitis, (3) ulcerative tracheo-bronchial tuberculosis, (4) tuberculosis of the larynx and oro-

pharynx, (5) draining cutaneous sinuses, and (6) tuberculous enteritis. In tuberculous peritonitis it is probably the treatment of choice. In genito-urinary tuberculosis its value is chiefly palliative and as an adjunct to surgery. In bone and joint tuberculosis it is helpful in some cases, both alone and in conjunction with surgery.

In pulmonary tuberculosis it is a valuable adjunct in exudative and pneumonic lesions, in combination with bed rest and collapse therapy, or resection when indicated. It must be emphasized that an understanding of the pathology of tuberculosis and of the mechanism of anti-bacterial therapy is necessary if the best possible end results are to be obtained by use of the drug. Streptomycin has proved that tuberculosis is amenable to chemotherapy. It is fervently hoped that other and even more effective agents may be discovered.

RESUMEN

Actualmente se reconoce que la estreptomycin es una arma valiosa en el tratamiento de la tuberculosis. Lo mismo que otras drogas valiosas, tiene sus ventajas y sus restricciones. No puede ser considerada como sustituto de la atención sanatorial o de otras medidas bien establecidas, tales como la colapsoterapia. Es obligatorio que se le emplee en el tratamiento de (1) la tuberculosis miliar, (2) la meningitis tuberculosa, (3) la tuberculosis tráqueobronquial ulcerativa, (4) la tuberculosis de la laringe y de la faringe bucal, (5) las fístulas cutáneas y (6) la enteritis tuberculosa. En la peritonitis tuberculosa es probablemente el tratamiento preferible. En la tuberculosis génitourinaria su valor es principalmente paliativo y como coadyuvante de la intervención quirúrgica. En la tuberculosis de los huesos y las articulaciones es útil en algunos casos, tanto sola como combinada con la intervención quirúrgica.

En la tuberculosis pulmonar es un coadyuvante valioso en lesiones exudativas y neumónicas, combinada con el reposo en cama y la colapsoterapia, o la resección cuando esté indicada. Debe recalcar que es necesario comprender la patología de la tuberculosis y el mecanismo de la terapia antibacteriana para que se puedan obtener los mejores resultados posibles con el empleo de la droga. La estreptomycin ha demostrado que la tuberculosis es tratable mediante la quimioterapia. Se espera fervorosamente que se puedan descubrir otros agentes aun más eficaces.

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Editorial

ANOTHER OUTSTANDING PROGRAM

The Program Committee, of the American College of Chest Physicians, with Dr Richard Overholt as Chairman, has arranged for a splendid array of speakers on a large variety of subjects pertaining to diseases of the chest for the Fourteenth Annual Meeting of the College to be held at the Congress Hotel in Chicago from June 17 to 20, inclusive. A copy of the preliminary program appears in this issue of "Diseases of the Chest." Many nations are represented by speakers on this program. Thus there will be an opportunity for physicians from various parts of the world to compare diagnostic criteria and preventive measures as practiced in their nations. It has long been recognized that most of the problems in chest diseases must be solved on a world-wide basis. This program, therefore, affords a marvelous opportunity to exchange thoughts, ideas and methods leading to coordination of activity throughout the world. In addition to the formal addresses and discussions, numerous clinics and demonstrations will be held.

This year a new feature of round table luncheon meetings has been added to the program of the College. Here all physicians who desire will have an opportunity to discuss and contribute to the knowledge of the subjects under consideration at the various round table sessions.

At the annual meeting of the American Medical Association held in Atlantic City in 1947 a Section on Diseases of the Chest in the Scientific Assembly of the American Medical Association was established. This was a far-reaching step toward the goal of chest disease control and eradication. The first program of this newly created Section on Diseases of the Chest will be held on Thursday morning, June 24th. This will consist of a symposium on streptomycin presented by Drs. Bogen, Hinshaw, Pfuetze, Tucker, Beattie and Keefer, all of whom have done outstanding work on various aspects of the therapeutic uses and values in tuberculosis. It is exceedingly important that all members of the College of Chest Physicians, after their regular session, remain for the meetings of the American Medical Association and be present for the program of the newly created Section on Diseases of the Chest.

It is anticipated that the attendance at the Chicago meeting of the College in 1948 will exceed that of the Atlantic City meeting in 1947 which was the largest attendance on record. A great deal of time has been devoted to the preparation of the program, and the speakers and discussers are putting forth their best efforts on a large volume of material covering nearly all phases of chest diseases that will be interestingly presented, highly informative and thoroughly practical. Thus, every physician who attends these sessions can become better equipped to practice chest diseases when he returns to his home sphere of activities.

J A M

FOURTEENTH ANNUAL MEETING

AMERICAN COLLEGE OF CHEST PHYSICIANS

CONGRESS HOTEL, CHICAGO, ILLINOIS

June 17 - 20, 1948

P R O G R A M

Thursday, June 17

Oral and Written Examinations for Fellowship

The Board of Examiners of the College will conduct oral and written examinations for Fellowship on Thursday, June 17, at the Congress Hotel, Chicago, Illinois. The members of the Board of Examiners are

Alvis E Greer, M.D., Houston, Texas, Chairman
Edward W Hayes, M.D. Monrovia, California, Vice-Chairman
Edgar Mayer, M.D., New York, New York Secretary
Louis H Clerf, M.D., Philadelphia, Pennsylvania
Alton Ochsner M.D., New Orleans, Louisiana

Executive Council Meeting

Board of Regents Meeting

Board of Governors Meeting

Council and Committee Meetings

Friday, June 18

9 00 a.m. SESSION NO I

Dr Edwin R Levine, Chicago, Illinois, Moderator

Dr Irving Sarot New York N Y Enucleation Technique for Lung Containing Adhesions"

Discussor Dr William Tuttle Detroit, Michigan

Dr Francisco Torres Cordoba, Argentina "Pulmonary Resection in Tuberculosis"

Discussor Dr J D Murphy Oteen North Carolina

Dr George Wright, Saranac Lake New York "Effect of Disease on Pulmonary Physiology"

Dr George G Ornstein, New York, N Y "Pulmonary Function"

Discussor Dr Benjamin P Potter Jersey City, N J (To discuss both Dr Wright's and Dr Ornstein's papers)

2 00 p.m. SESSION NO II

Dr Richard H Overholt Brookline, Massachusetts, Moderator

Dr Karl Poppe Portland, Oregon "Treatment of Aortic Aneurysms by Wrapping with Foreign Body"

Discussor Dr Osler Abbott, Atlanta Georgia

Dr Charles P Bailey, Philadelphia Pennsylvania "Surgical Treatment of Mitral Stenosis"

Discussor Dr Horace G Smithy Charleston South Carolina

Dr Willis J Potts, Chicago Illinois "Recent Advances in Intrathoracic Vascular Surgery"

Dr O T Clagett Rochester Minnesota "Surgical Treatment of Emphysematous Blebs and Bullae"

Discussor Dr Francis M Woods, Brookline Massachusetts

Dr Everts A Graham, St Louis Missouri "Problem of Cancer of the Lung"

Discussor Dr W E Adams, Chicago, Illinois

Saturday, June 19**9 00 to 10 30 a m ADMINISTRATIVE SESSION**

Recommendations for elective officers for the College should be sent to the Chairman of the Nominating Committee

Walter E Vest, M D, Huntington, West Virginia, Chairman
 Carl H Gellenthien, M D, Valmora, New Mexico
 Hubert A Boyle, M D, New Bedford, Massachusetts

10 30 a m SESSION NO III

X-ray Conference (Proved cases of unusual interest will be discussed)

2 00 p m SESSION NO IV

Dr Francis J Weber, Washington, D C, Moderator

Symposium on BCG Vaccination

Dr Ismael Coslo Villegas, Mexico City, Mexico "The Experience with BCG Vaccination in Latin America"

Dr Milton I Levine, New York, N Y "Experience with BCG Vaccination in New York City"

Dr Jose I Baldo, Caracas, Venezuela "BCG Vaccination in Venezuela"

Dr Gumersindo Sayago, Cordoba, Argentina "Experience with BCG in Argentina"

Dr Arlindo de Assis, Rio de Janeiro, Brazil "Concurrent BCG Vaccination"

Dr Herman E Hilleboe, Albany, New York "The BCG Program of New York State"

"Closing Remarks," Chairman

Sunday, June 20**9 00 a m SESSION NO V**

Dr Andrew L Banyai, Milwaukee, Wisconsin, Moderator

Dr Marcio Bueno, New Bedford, Massachusetts "Diagnostic Bronchial Lavage in Tuberculosis"

Dr George N Papanicolaou, and Dr Henry A Cromwell, New York, N Y "Diagnosis of Cancer of the Lung by the Cytologic Method"

Dr Seymour M Farber, San Francisco, California "Diagnosis of Primary Carcinoma of the Lung by means of Cytological Examination of Sputum and Bronchial Secretions"

Dr Maurice M Black, Brooklyn, New York "Biochemical Studies in Cancer Diagnosis"

Dr Andre Soulas, Paris, France "Study of Bronchial Stenosis in Bronchopulmonary Tuberculosis"

2 00 p m SESSION NO VI

Dr Harry C Warren, San Francisco, California, Moderator

Dr Allan Hurst, Dr Jules V Coleman, and Ruth Hornbein, M S S, Denver, Colorado "The Place of Psychiatry in the Problem of a Tuberculosis Hospital"

Dr Willard Van Hazel, Dr Paul H Holinger, and Dr Robert J Jensch, Chicago, Illinois "Adenoma of the Bronchus"

Dr Italo Volini, Dr James R Hughes, and Dr John Pepper, Chicago, Illinois "A Comparative Study of Sulfadiazine, Penicillin and Penicillin Combined with Sulfadiazine in the Treatment of Lobar Pneumonia"

Dr Ben E Goodrich, and Dr T D Johnson, Detroit, Michigan "Chronic Bilateral Basal Pulmonary Fibrosis"

Dr Maurice Segal, Boston, Massachusetts "Facts and Fancies in the Management of the Seriously Ill Patient with Bronchial Asthma"

Discussor Dr George L Waldbott, Detroit, Michigan

Note The names of the additional discussors will appear in the final program

COUNCIL LUNCHEON MEETINGS

Thursday, June 17

Annual Conference of College Chapter Officials

Dr Carl C Aven, Atlanta, Georgia, Chairman, Presiding

Dr Seymour M Farber, San Francisco, California, Secretary-Treasurer, California Chapter "Report of the Conference Secretary"

Dr Nelson W Strohm, Buffalo, New York, Past-President, New York State Chapter, Vice-Speaker, House of Delegates, New York State Medical Society "Preparing and Presenting a Program on Diseases of the Chest in Connection with the Annual Meeting of the State Medical Society"

Dr Irving Willner Newark, New Jersey, Past-President, New Jersey Chapter "Establishing a Section on Diseases of the Chest in a State Medical Society"

Dr Leon H Hirsh, Milwaukee, Wisconsin, Secretary-Treasurer, Wisconsin Chapter "Program Planning and Attendance Building for Chapter Meetings"

Dr W Bernard Yegge, Denver, Colorado, Secretary-Treasurer, Rocky Mountain Chapter "Correlating Chapter Activities with the Program of the National Organization"

Dr Donato G Alarcon, Mexico City, Mexico, President, Mexican Chapter "Chapters in Other Countries"

Friday, June 18

Conference of Medical Directors and Superintendents of Tuberculosis

Hospitals and Sanatoria

Dr R S Anderson, Erie, Pennsylvania Chairman, Presiding, Dr E W Custer, South Bend, Indiana, Secretary

Dr Paul A Turner, Medical Director, State Tuberculosis Sanatorium Louisville, Kentucky, Guest Speaker "Essential Standards Necessary in Tuberculosis Hospitals"

Dr I D Bobrowitz, Otisville, New York "Report of the Committee on Sanatorium Standards"

Dr Allan Hurst, Denver, Colorado "Report of the Committee on Rehabilitation"

Saturday, June 19

Council on International Affairs

Council on Pan American Affairs, Council on European Affairs and Council on Pan Pacific Affairs

Dr Chevalier L Jackson, Philadelphia, Pennsylvania, Chairman, Council on Pan American Affairs, Presiding

Dr Manual Albertal, Buenos Aires, Argentina "Streptomycin in Tuberculosis Clinical Experience"

Dr Max Espinoza Galarza, Lima Peru "Tomography of the Larynx in Disseminated Tuberculosis"

Dr Jorge A Higgins, Guayaquil, Ecuador "Experimental and Clinical Verification of the Combined Vaccines Against Smallpox and Tuberculosis"

Sir Sidney Sewell, Melbourne Australia "Treatment of Chest Diseases in Australia"

Dr Basil A Dormer, Durban, South Africa "Treatment of Chest Diseases in South Africa"

Dr William E Ogden Toronto Canada "The Progress of the American College of Chest Physicians in Canada"

Dr Gustav Maurer Davos, Switzerland "The Progress of the American College of Chest Physicians in Europe"

Sunday, June 20**Council of Tuberculosis Committees**

Dr Jas H Stygall, Indianapolis, Indiana, Chairman, Presiding, Dr I Willner, Newark, New Jersey, Secretary

Symposium on Mass X-ray Surveys

Radiologist Dr Henry K Taylor, New York, N Y

Pathologist Dr Henry C Sweany, Chicago, Illinois

Epidemiology Dr R I Pierce, Chicago, Illinois

Chest Specialist Dr Allen Filek, Madison, Wisconsin

ROUND TABLE LUNCHEONS**Friday, June 18**

A-1 "Tuberculosis in Children," Dr Jay Arthur Myers, Minneapolis, Minnesota

A-2 "Treatment of Tuberculosis in Older Age Groups," Dr Arnold Anderson, St Petersburg, Florida

A-3 "Fungus Diseases," Dr Alvis E Greer, Houston, Texas

A-4 "Suppurative Diseases of the Lung," Dr Francis M Woods, Brookline, Massachusetts

A-5 "Relation of Race to Pulmonary Disease," Dr Julian Lewis, Chicago, Illinois

A-6 "Chronic Cor Pulmonale Associated with Chronic Pulmonary Disease," Dr Chauncey C Maher, Chicago, Illinois

Saturday, June 19

B-1 "Artificial Pneumoperitoneum," Dr Benjamin L Brock, Downey, Illinois

B-2 "Dust Diseases," Dr C Howard Marcy, Pittsburgh, Pennsylvania

B-3 "Boeck's Sarcoid," Dr David Relsner, Denver, Colorado

B-4 "Rehabilitation in Tuberculosis," Dr Sumner Cohen, Oak Terrace, Minnesota

B-5 "Emphysema and Pulmonary Disability," Dr George G Ornstein, New York, N Y

B-6 "Atypical Pneumonias," Dr Carl C Aven, Atlanta, Georgia

Sunday, June 20

C-1 "Handling of Minimal Case," Dr Herman E Hilleboe, Albany, N Y, and Dr Francis Weber, Washington, D C

C-2 "Aerosols and Bronchial Infection," Dr Alvin L Barach, New York, N Y

C-3 "When Should Artificial Pneumothorax be Terminated," Dr E W Hayes, Monrovia, California

C-4 "Rest and Early Ambulation," Dr J Winthrop Peabody, Washington, D C

C-5 "Pregnancy and Tuberculosis," Dr Donato G Alarcon, Mexico City, and Dr Frederick H Falls, Chicago, Illinois

C-6 "Dosage of Streptomycin," Dr Emil Bogen, Los Angeles, California

The round table luncheons will be limited to 20-30 persons each
Reservations will be accepted in the order in which they are received

Saturday, June 19**6 00 p m ANNUAL CONVOCATION**

The College will conduct a Convocation on Saturday, June 19, when Fellowship Certificates will be awarded The Convocation will be conducted by the Board of Regents of the College and will be open to members of the College, their families and friends A guest speaker will address the assembly

6 30 p m SOCIAL HOUR

7 30 p.m. ANNUAL PRESIDENTS' BANQUET

The Annual Presidents' Banquet will be held Saturday evening June 19 Major General S U Marietta, President of the College, will deliver his presidential address, and the President-Elect, Dr Richard H Overholt, will be installed as President

COLLEGE MEDAL

The second College Medal will be awarded at the Presidents' Banquet The members of the Committee on College Awards are

Edward W Hayes, M.D, Monrovia, California, Chairman
 Jay Arthur Myers, M.D, Minneapolis, Minnesota, Vice-Chairman
 Minas Joannides, M.D, Chicago, Illinois, Secretary
 Donato G Alarcon, M.D, Mexico City, Mexico
 J Winthrop Peabody, M.D, Washington, D C

C L I N I C S**Monday, June 21**

3 00 p.m. Alexian Brothers Hospital

Demonstration of treatment of Pulmonary Tuberculosis with the use of the Lung Immobilizing Chamber (Barach)
 Courtesy of Dr Minas Joannides

Tuesday, June 22

10 00 a.m. Congress Hotel

Demonstration of the Pneumostat, a new apparatus for constant controlled pneumothorax
 Courtesy of Dr A I Breckler and Dr Edwin R Levine

2 00 p.m. Educational Research Hospital, University of Illinois

Kodachrome clinic of anatomy and pathology of tracheo-bronchial tree Courtesy of Dr Paul H Holinger

Wednesday, June 23

11 00 a.m. Amphitheater, Cook County Children's Hospital

Demonstration on BCG
 Courtesy of Dr Sol Roy Rosenthal and Dr Erhard Loewensohn

2 00 p.m. Navy Pier and Hotel Sheraton

Television broadcast of major surgical operation from Northwestern University Medical School

Thursday Morning, June 24

Session on Diseases of the Chest for the Newly Created Section on Diseases of the Chest in the Scientific Assembly of the American Medical Association

Officers of the Session

Dr Richard H Overholt, Brookline, Massachusetts, Chairman
 Dr J Winthrop Peabody, Washington, D C, Secretary

SYMPOSIUM ON STREPTOMYCIN

Dr Emil Bogen, Los Angeles, California

"Laboratory Aspects of Streptomycin"

Dr H C Hinshaw Rochester Minnesota

"Streptomycin in Extrapulmonary Tuberculosis"

Dr Karl H Pfuete, Cannon Falls, Minnesota

"Streptomycin in the Treatment of Tuberculosis"

Dr William Tucker Minneapolis, Minnesota

Experience with Treatment of Various Forms of Tuberculosis with Streptomycin in the Veterans Administration"

Dr Edward Beattie, Washington, D C

Use of Streptomycin in Surgical Patients"

Dr Chester Keefer Boston Massachusetts

"Antibiotics in Relation to Non-Tuberculous Chest Diseases"

Council on Pan American Affairs

Puerto Rico Chapter

The quarterly meeting of the Puerto Rico Chapter of the College was held on March 14, at the home of Dr Phillip Gorlin in Ponce

Venezuelan Chapter

The present officers of the Venezuelan Chapter of the College are as follows

Dr Jose Ignacio Baldo, Caracas, President
 Dr Julio Criollo Rivas, Caracas, Vice-President
 Dr Rogelio Valladares, Caracas Secretary-Treasurer

The new journal "Revista Panamericana de Medicina y Cirugia del Torax" publishes news notes of College activities in Spanish, and scientific articles are published in both Spanish and English. Physicians interested in subscribing to this new journal should write to the Editor Dr Donato G Alarcon, Amazonas 96 Mexico City Mexico

Dr Segundo Brana Blanco, Veracruz, Mexico, has been appointed as Jefe del Departamento de Tuberculoso del Hospital Civil in Veracruz

The officers of the Sociedad Paraense de Fisiologia, Belem, Para, Brazil, elected for the year 1948-1949 are as follows: Dr Luiz Araujo, Presidente, Dr Oscar Miranda Secretario, Dr Joao Ramos Ribeiro, Treasurer and Dr Geraldo Correa and Dr Honorato Neves as members of the Review Committee

Dr Rene G Mendoza, Havana, Cuba, has been elected President of the Sociedad Cubana de Fisiologia for the ensuing year

Dr Salvador Diaz, Santiago Chile, has been appointed Secretary of the Santiago Chapter of the College. The Santiago Chapter is planning to hold its organizational meeting this spring

The following physicians in the Pan American area outside of the United States, have notified the Executive Offices of the College that they are planning to attend the 14th Annual Meeting in Chicago, Illinois, June 17-20

Dr Antonio Acosta Velarde, Santurce, Puerto Rico
 Dr Donato G Alarcon, Mexico City, Mexico
 Dr Manuel Albertal, Buenos Aires, Argentina
 Dr Gustavo Aldereguia, Havana, Cuba
 Dr G C Anglin, Toronto, Ontario, Canada
 Dr J Garcia Arrazuria, Havana, Cuba
 Dr Jose Ignacio Baldo, Caracas, Venezuela
 Dr A H Baker, Calgary, Alberta, Canada
 Dr Juan J Castillo, Havana, Cuba
 Dr Enrique Coronado Iturbide, Guatemala City, Guatemala
 Dr Ismael Cosio Villegas, Mexico City, Mexico
 Dr Arlindo de Assis, Rio de Janeiro, Brazil
 Dr Max Espinoza Galarza, Lima, Peru
 Dr Elihu J Gutierrez, Mexico City, Mexico
 Dr I H Herman, Saskatoon, Sask, Canada
 Dr Jorge A Higgins, Guayaquil, Ecuador

Dr Miguel Jimenez, Mexico City, Mexico
 Dr G F Kincade, Vancouver, B C, Canada
 Dr Harold I Kinsey Toronto, Ontario Canada
 Dr Miguel C Lascaia, Buenos Aires, Argentina
 Dr Rafael H Leal, Guatemala City, Guatemala
 Dr Simon Marcus, Sherbrooke, P Q, Canada
 Dr A Marshall, Tranquille, B C Canada
 Dr W K Massey, Nelson, B C, Canada
 Dr C C McLean, Kitchener, Ontario, Canada
 Dr Rene G Mendoza, Havana, Cuba
 Dr Antonio Navarette Havana, Cuba
 Dr William E Ogden, Toronto, Ontario, Canada
 Dr J Rubin, Outremont P Q Canada
 Dr A J Pereira Rego, Rio de Janeiro, Brazil
 Dr Gumerindo Sayago, Cordoba, Argentina
 Dr Alexander C Sinclair, St Vital, Manitoba Canada
 Dr Francisco Torres, Cordoba, Argentina
 Dr A R Valle, Seward Alaska
 Dr Agnes M Walker, Hamilton, Ontario, Canada

Council on European Affairs

Greek Chapter

A meeting of the Greek Chapter of the College took place in Athens on January 21, 1948 The present officers of the chapter are

Dr Basil Papanikolaou, Athens, President
 Dr Kyriakos Katrakis, Athens, Vice-President
 Dr Nicholas Giannopoulos, Athens, Secretary-Treasurer

Dr Paul Veran of Nantes, France, has been appointed Governor of the College for France

Dr Francis Kovats of Budapest Hungary, has been appointed Governor of the College for Hungary

Dr Lopo de Carvalho of Lisbon, Portugal, has been appointed Governor of the College for Portugal

The following physicians in Europe are planning to be present at the 14th Annual Meeting of the College in Chicago Illinois, June 17-20

Dr Gustav Maurer, Davos Switzerland
 Dr Andre Soulas, Paris, France

Council on Pan Pacific Affairs

South African Chapter Organized

The organizational meeting of the first South African Chapter took place in Cape Town on April 8, 1948 The Constitution and By-Laws were formally presented and adopted by the members present, and the following officers were elected for the chapter

Dr David P Marais Cape Town President
 Dr T Shrire, Cape Town, Vice-President
 Dr H Jacob, Cape Town, Secretary-Treasurer

A photograph of the inaugural meeting was taken especially for publication in this issue of the journal and will be found on page 464

ORGANIZATIONAL MEETING, SOUTH AFRICAN CHAPTER, AMERICAN COLLEGE OF CHEST PHYSICIANS
CAPETOWN, SOUTH AFRICA, APRIL 8, 1948



Seated, left to right H O Hofmeyr, MD, FCCP, T Schrire, MD, FCCP, Vice-President, D P Marais, MD, FCCP, President and Governor of the College for South Africa, H H Jacob, MD, FCCP, Secretary-Treasurer, A Landau, MD, FCCP — Standing, left to right W Phillips, MD, FCCP, D A Luckhoff, MD, H Muller, MD, J O Marais, MD, W L Hoole, MD, FCCP

Dr Raman Viswanathan of New Delhi, India, has been appointed Governor of the College for India

Dr D B Rosenthal of Melbourne, Australia, is visiting in the British Isles and is planning to visit a number of other European countries during his tour

The following physicians in the Pan Pacific area are planning to attend the 14th Annual Meeting of the College in Chicago, Ill, June 17-20

Dr Basil A Dormer, Durban, South Africa
Dr Frederick L Giles, Honolulu, T H
Dr W Cotter Harvey, Sydney, Australia
Dr Edmund L Lee, Honolulu, T H
Dr Alan H Penington, Melbourne, Australia
Dr Forrest J Pinkerton, Honolulu T H
Dr Karun Sankar Ray, Calcutta, India
Sir Sidney Sewell Melbourne, Australia
Dr S H Tsai, China

College Chapter News

ARIZONA CHAPTER

The Arizona Chapter of the College will hold its annual meeting on May 19 at the Westward Ho Hotel, in Phoenix The following program will be presented

"Bronchography," Howell Randolph M.D, F C C P, Phoenix Arizona
'Exploratory Thoracotomy in Obscure Thoracic Disease,"
John B Grow M.D, F C C P, Denver, Colorado
'The Use of the Laboratory in Controlling the Treatment of Tuberculosis," C Richard Smith M.D, Los Angeles, California

The scientific program will be followed by a luncheon and business meeting of the chapter The guest speaker at the luncheon will be Dr J Dewey Bisgard of Omaha, Nebraska, who will discuss "Resection for Non-Tuberculous Pulmonary Disease "

CALIFORNIA CHAPTER

At the annual meeting of the California Chapter of the College, held on April 10 the following officers were elected to office for the ensuing year

Cabot Brown M.D San Francisco, President
Lyman A Brewer, III M.D, Los Angeles, Vice-President
Seymour M Farber, M.D, San Francisco, Secretary-Treasurer

INDIANA CHAPTER

The Indiana Chapter of the College held a luncheon meeting at the Columbia Club Indianapolis on Sunday April 18 A scientific program followed presided over by Dr J V Pace F C C P, New Albany, President of the chapter The following papers were presented

'Value of Planigrams in Chest Conditions '
Phillip Cohn, M.D, New Albany

DINNER, FIRST ANNUAL POSTGRADUATE COURSE IN DISEASES OF THE CHEST



Sponsored by the Council on Postgraduate Medical Education of the American College of Chest Physicians and the Laennec Society of Philadelphia. Barclay Hotel, Philadelphia, Monday, March 15, 1948

"Pleural Effusions,"

Edward W Custer, M.D, F C C P, South Bend

"Intrathoracic Tumors and Cysts,"

John V Thompson, M.D, F C C P, Indianapolis

The meeting closed with an X-ray Conference at which many interesting films were shown

MICHIGAN CHAPTER

The Michigan Chapter of the College held its spring meeting in Detroit on March 30 at the Detroit Tuberculosis Sanatorium Dinner was served and following this, Dr Richard H Overholt, Brookline, Massachusetts, President-Elect of the American College of Chest Physicians, the guest speaker, was introduced Dr Overholt spoke on "Significance of Segmental Resection in Thoracic Diseases," which was followed by an interesting discussion

A business meeting and election of officers was held The Fall meeting was discussed, which will be held in September in conjunction with the Michigan State Medical Society meeting in the Book Cadillac Hotel Detroit The 1947 officers of the chapter were re-elected as follows

Arthur R Young, M.D, Pontiac, President

William P Chester, M.D, Detroit, Vice-President

Cletus J Golinvaux, M.D, Monroe, Secretary-Treasurer

The Michigan Chapter expressed its thanks to the Staff of the Detroit Tuberculosis Sanatorium for their hospitality

MISSOURI CHAPTER

The new officers of the Missouri Chapter of the College recently elected for the year 1948 are as follows

George D Kettelkamp, M.D, Koch President

Alfred Goldman M.D, St Louis, Vice-President

A J Steiner, M.D, St Louis Secretary-Treasurer (re-elected)

The following committees have been appointed by the President

Membership Committee

Charles A. Brasher M.D, Mt Vernon, Chairman

Jesse E Douglass, M.D Webb City

Louis Levin M.D Excelsior Springs

Medical Education Committee

James L Mudd M.D St Louis Chairman

Alfred Goldman M.D St Louis

Sam H Snider M.D, Kansas City

Program Committee

Herbert L Mantz M.D Kansas City, Chairman

William W Buckingham, M.D, Kansas City

Bernard Friedman M.D Koch

NEW JERSEY CHAPTER

The New Jersey Chapter of the College met at Haddon Hall, Atlantic City, on April 28 in connection with the annual meeting of the Medical Society of New Jersey The scientific program was presented in the Section on Diseases of the Chest in the state medical society on that day The Medical Society of New Jersey is the first state medical society

FIRST ANNUAL POSTGRADUATE COURSE IN DISEASES OF THE CHEST SPONSORED BY THE COUNCIL ON POSTGRADUATE MEDICAL EDUCATION, AMERICAN COLLEGE OF CHEST PHYSICIANS AND THE LAENNEC SOCIETY OF PHILADELPHIA
WARWICK HOTEL, PHILADELPHIA, PENNSYLVANIA, MARCH 15-20, 1948



Some of the physicians and instructors who participated in the First Annual Postgraduate Course in Diseases of the Chest

to establish a Section on Diseases of the Chest in their scientific assembly

Following the scientific section, the New Jersey Chapter held its annual meeting and dinner at the hotel. The following officers were elected for the ensuing year

Paul K. Bornstein, M.D., Asbury Park, President
 Homer H. Cherry, M.D., Paterson, First Vice-President
 Bertram S. Pollak, M.D., Jersey City, Second Vice-President
 Benjamin P. Potter, M.D., Jersey City, Secretary-Treasurer

NORTH MIDWEST CHAPTER

The North Midwest Chapter will hold its annual meeting on June 7 at the Radisson Hotel, Minneapolis, at the time of the annual meeting of the Minnesota State Medical Association. There will be a luncheon for College members and guests at the Radisson Hotel at 12 00 noon, at which time a business meeting of the chapter will be held. A scientific program will follow at 2 00 p. m. The program to be presented is given below

Jay Arthur Myers, M.D., F.C.C.P., Minneapolis, Moderator

"Dangers of Delay in the Diagnosis of Indeterminate Pulmonary Lesions,"

Allen Good, M.D., Rochester

Discussors: E. P. J. Fenger, M.D., Oak Terrace,
 Thomas Lowry, M.D., Minneapolis

"Some Experiences with Streptomycin in the Treatment of Tuberculosis in the Veterans Administration,"

William B. Tucker, M.D., Minneapolis

Discussors: Russell Frost, M.D., F.C.C.P., St. Paul,
 Karl H. Pfuetze, M.D., F.C.C.P., Cannon Falls

"Nebulization Therapy for Pulmonary Diseases,"

Arthur Olsen, M.D., Rochester

Discussors: Jay Arthur Myers, M.D., F.C.C.P., Minneapolis,
 G. A. Hedberg, M.D., F.C.C.P., Nopeming

"Diagnosis of Peripheral Lung Tumors Observed in Chest Survey,"

David Sharp, M.D., F.C.C.P. and

Robert Nord, M.D., Minneapolis

Discussors: William Roemmich, M.D., Minneapolis
 Sumner S. Cohen, M.D., F.C.C.P., Oak Terrace

OHIO CHAPTER

At the annual meeting of the Ohio Chapter held in Cincinnati on March 31, the following officers were elected for the year 1948-1949

William J. Habeeb, M.D., Springfield, President

Garry G. Bassett, M.D., Lakewood, Vice-President

Everett F. Conlogue, M.D., Dayton, Secretary-Treasurer

Dr. Louis Mark Columbus made a motion at the business meeting of the Ohio Chapter that the chapter donate \$100.00 to the Research Fund that has been set up by the national organization, this money to be taken from the Ohio Chapter Treasury. The motion was seconded by Dr. William Habeeb. It was carried unanimously and the Treasurer was directed to send the contribution to the Executive offices of the College

POTOMAC CHAPTER

The following officers of the Potomac Chapter were elected at the chapter meeting in Baltimore, Maryland, on April 26

Otto C Brantigan, M D , Baltimore, Maryland, President
Edgar W Davis, M D , Washington, D C , Vice-President
Milton Kress, M D , Towson, Maryland, Secretary-Treasurer

TEXAS CHAPTER

The Texas Chapter held its annual meeting in Houston on April 26, and the following officers were elected for the year 1948-1949

Robert B Homan Jr , M.D , El Paso, President
Elliott Mendenhall, M D , Dallas, First Vice-President
Jesse B White, M D , Amarillo, Second Vice-President
Charles J Koerth, M D , Kerrville, Secretary-Treasurer

NEW YORK STATE CHAPTER

On the evening of May 20 an informal dinner of the New York State Chapter of the College will be held at the Hotel Pennsylvania, New York City. A business meeting and election of officers will be held which is to be followed by an address by Major General S U Marietta, President of the American College of Chest Physicians

In the afternoon of May 20 a symposium of Primary Carcinoma of the Lung has been arranged by Dr Joseph J Witt, Chairman, Session on Chest Diseases of the Medical Society of the State of New York. It is as follows

"Diagnosis,"

John Hayes, M.D , Saranac Lake, New York

"Pathological Aspects,"

Oscar Auerbach, M D , New York, N Y

"Role of the Bronchoscopist in Diagnosis and Treatment,"

Louis Clerf, M D , F C C P , Philadelphia, Pennsylvania

"Treatment,"

Richard H Overholt, M.D , F C C P , Brookline, Massachusetts

ILLINOIS CHAPTER

The annual meeting of the Illinois Chapter was held at the Palmer House, Chicago, on Monday evening, May 20. A business meeting and election of officers was held and Dr Roy A Wolford, Acting Assistant Medical Director for Professional Services, Veterans Administration, Washington, D C , was the guest speaker. His subject was "Program of the Veterans Administration on Diseases of the Chest."

The new officers elected for the chapter are as follows

Kenneth G Bulley, M.D , Aurora, President
Darrell H Trumpe, M.D , Springfield, Vice-President
Edwin R Levine, M D , Chicago, Secretary-Treasurer

The following members of the College presented papers at the Annual Meeting of the Illinois State Medical Society, Chicago, May 10, 11 and 12

"The Present Status of Streptomycin,"

Dr Karl H Pfuetze, Cannon Falls, Minnesota

"The Physician's Responsibility Toward the Hard of Hearing and Deafened,"

Dr Francis L Lederer, Chicago, Illinois

"The Treatment of Pneumonia with Single Daily Intramuscular Injections of Penicillin and Wax,"

Dr Italo Volini, Chicago, Illinois

"Early Diagnosis of Cancer of the Stomach "

Dr Leo G Rigler, Minneapolis, Minnesota

"Recent Techniques in the Management of Bronchial Infections,"

Dr Edwin R Levine, Chicago, Illinois

"Detection of Various Chest Lesions by Mass X-ray Surveys,"

Dr Dan Morse, Peoria, Illinois

Dr Paul H Holinger Chicago Illinois, presided at the session on Monday afternoon, May 10, and at the Section on Eye, Ear, Nose and Throat on Tuesday morning, May 11 Dr S A Levinson Chicago, Illinois, presided at the Section on Pathology on Tuesday afternoon, May 11

College News Notes

Harry C Warren, M.D, F C C P, San Francisco, California, Second Vice-President of the College, has been elected President of the California Tuberculosis and Health Association, and Edward W Hayes, M.D., F C C P, Monrovia, California, a Past-President of the College, has been elected as Vice-Chairman of the association

Paul H Holinger, M.D, F C C P, Chicago, Illinois, was elected President of the American Broncho-Esophagological Association at their 29th Annual Meeting held in Atlantic City in April Dr Holinger formerly served as Secretary-Treasurer of the Association

Alvan L Barach, M.D, F C C P, George F Herben, M.D, F C C P, James H Cullen M.D, F C C P, and Chesmore Eastlake, M.D, New York New York, will present a paper entitled "Clinical Recovery in Advanced Pulmonary Tuberculosis Induced by Total Lung Rest in the Immobilizing Lung Chamber," in the Scientific Assembly of the American Medical Association in June Dr Barach will also have a booth in the scientific exhibit of the American Medical Association on "Immobilizing Lung Chamber Therapy in Pulmonary Tuberculosis "

Seymour M Farber M.D, F C C P, San Francisco, California, presented a paper on "Bronchogenic Carcinoma" before the annual meeting of the California Medical Association and the American College of Physicians which took place in San Francisco in April

R S Anderson, M.D F C C P, Erie Pennsylvania, has been appointed to succeed Benjamin L Brock, M.D, F C C P, Downey, Illinois, as Chairman of the Council of Medical Directors and Superintendents of Tuberculosis Hospitals and Sanatoria of the College Dr Anderson formerly served as Secretary of the Council E W Custer M.D, F C C P, South Bend Indiana has been appointed to the office of Secretary of the Council Dr Brock recently joined the staff of the Veterans Hospital at Downey Illinois

J Edmond Bryant M.D F C C P Evanston, Illinois, recently returned from a visit to Haiti, where he had an opportunity to meet with other members of the College

Obituaries

PROFESSOR ENRIQUE FINOCHIETTO

1881 - 1948



In the history of South American surgery, Professor Enrique Finochietto represents the figure of greatest scientific prestige. His creative talent and investigator's soul brought him to the perfecting of many surgical techniques, animated with an enthusiasm only comparable to the greatest masters of all times.

Modest and unassuming, he never obtruded his personality or exploited his merits or achievements as claim for priority, but

rather referred to himself in an impersonal way, and allowed the facts to speak for themselves. It is not only because he was one of the greatest surgeons of his generation that he deserves special homage, nor even because of the great debt which surgery owes him, but more especially for his fundamental contributions to the enlargement of the field of surgery and to the elevation of its standards to a nobler height.

He created methods in surgery, which he taught using continuously his own unexcelled skill as an example in the operating room. He was always ready to suggest new ideas, urging the younger men who surrounded him, to explore new paths, remaining unto the end the inspirer and the undisputed chief of a group of brilliant men.

Professor Enrique Finochietto was born the 13th of March 1881. He graduated from the Medical School of the University of Buenos Aires with highest honours. He was appointed surgeon on the staff of the Rawson Hospital. He went abroad several times to Europe and the United States, to study with the eminent men in the field of surgery. It was on one of these trips that the French Government conferred upon him the honorary title of the Officer of the Legion of Honor, and later he received the medal of the Red Cross of Paris and the Golden Medal given to him for his surgical services to the soldiers.

He won the appointment of surgeon in chief at the Rawson Hospital through competitive examination and later became professor of surgery in the School of Medicine of the University of Buenos Aires.

He was president of several surgical congresses and a member of institutions of world prestige, enjoying the respect and admiration of his European and American colleagues. At the conclusion of thirty years of scientific work, his pupils offered him a golden book with a series of original papers about subjects studied under his tutelage, giving him in such a way sincere homage.

The Finochietto brothers, who represent in South America, what the Mayo brothers represent in the United States, are publishing a fundamental treatise of surgery received with keen attention in the medical centers all over the world. This "magnus opus" will be terminated by Professor Ricardo Finochietto, twin personality of his eminent brother with whom he was always the most admirable co-worker.

With his illustrious brother Prof Ricardo Finochietto, who survives him, they have created a surgical school of the greatest renown which includes the most brilliant group of surgeons of the Argentine Republic

The Finochietto school of surgery through the Surgical Sessions for Postgraduates, the most qualified teaching institution of the continent created under the inspiration of Enrique Finochietto and directed by Ricardo Finochietto, has become the Mecca of the South American Surgery where surgeons come in ever increasing numbers The name Finochietto represents a symbol of surgery at its best in South America, being at the same time synonymous with the art of surgery in the highest conception of the term

Dr Enrique Finochietto attacked every problem that came before him at the foundation He was not satisfied with the superstructure and would not rest until assured of the security of its base

His artistic sense, his wide culture, his manual dexterity, his absolute assurance, his tenacity of purpose all made professor Enrique Finochietto, whose death occurred the 17th of February 1948, in the middle of his best creative capacity, one of the greatest surgeons of the century

Considerado universalmente como una figura del mas elevado prestigio científico el Prof Enrique Finochietto representa en la historia de la cirugía sud-americana el valor estelar de mayor magnitud

Su alma de investigador lo llevo al terreno de la especulación científica y su talento creador lo condujo a la perfección de la técnica quirúrgica animándolo para ello un entusiasmo parangonable solo al de los grandes maestros de todas las épocas

Dotado de un espíritu crítico profundo su labor ha sido trascendental y la simiente que ha ido esparciendo ha dado fruto fecundos, reflejándose en los innumerables discípulos a los cuales su obra seguira iluminando en el futuro Creador de metodos y de sistemas quirurgicos los aplicaba enseñando, constantemente dando la lección incomparable de su propia labor en la sala de cirugía sin dar a su impropia tarea la mínima suntuosidad espectacular

No menos importante que sus fundamentales contribuciones a la cirugía fueron el resultado del impacto de su personalidad, sobre los numerosos discípulos que ha formado, inspirándoles constantemente un anhelo de superación integral

Habia nacido el Dr Enrique Finochietto el 13 de Marzo de 1881 Curso sus estudios universitarios en la Facultad de Medicina de Buenos Aires donde obtuvo su título de doctor en medicina con la actuación mas sobresaliente

Nombrado cirujano del Hospital Rawson efectuó repetidos viajes de estudio a Europa y Estados Unidos para apreciar los procedimientos de los grandes maestros de la época En uno de estos viajes el gobierno de Francia le confirió el título de Oficial de la Legión de Honor y posteriormente recibió la medalla de la Cruz Roja de París y la de oro de la Guerra otorgada por su atención a los soldados

Obtuvo por concurso los cargos de jefe de Cirugía del Hospital Rawson y luego Professor de Cirugía en la Escuela de Medicina de la Universidad de Buenos Aires

Presidió congresos y reuniones de especialistas fue miembro de las instituciones de mayor prestigio mundial gozando del respeto y admiración de sus colegas europeos y americanos de mas alta jerarquía

Cuando cumplio 30 años de labor científica sus discipulos reunieron en un libro de Oro una seile de trabajos originales sobre temas estudiados bajo la direccion del Maestro, rindiéndole en esa forma un homenaje justiciero

Con su ilustre hermano, el Profesor Ricardo Finochietto que lo sobrevive, han creado la escuela quirurgica del mayor prestigio, que agrupa al nucleo de cirujanos mas brillantes del continente Los hermanos Finochietto, que representan en Sud-America, lo que los hermanos Mayo significaron en los Estados Unidos, han iniciado la publicacion de una obra fundamental y consagratoria, recibida con interés muy vivo en los medios cientificos universales

Esta obra ciclopea sera terminado por el Profesor Ricardo Finochietto, personalidad gemela de su eminente hermano, del cual fuera siempre el colaborado admirable

La escuela Finochietto gracias a las sesiones Quirurgicas para Graduados, institucion docente mas calificada del continente, creado bajo la inspiracion de Enrique Finochietto, ordenadas y dirigidas por Ricardo Finochietto, se han transformado en la Meca de la Cirujía Sud Americana, donde seguiran concurriendo en forma creciente, los cirujanos de la Republica Argentina y de todos los países del continente a perfeccionar sus conocimientos quirurgicos

El nombre Finochietto representa un simbolo en la cirugia del continente siendo a su vez sinónimo de arte quirurgico en la mas elevada acepción del termino

Su elevado sentido artistico, su delicadeza de espiritu, su cultura integral, su agilidad mental, su extraordinaria habilidad técnica, puestas al servicio de una disciplina tenaz, todas estas cualidades hicieron del Profesor Enrique Finochietto, desaparecido el 17 de Febrero de 1948 en la plenitud de su capacidad creadora, uno de los grandes cirujanos del siglo

David Fairman, M.D

LEON GILBERT WOODFORD

1882 - 1947

Dr Leon Gilbert Woodford was born in Coal Creek, Colorado, on June 19, 1882 He graduated from the University of Colorado in 1909 and in 1910 went to Everett, Washington where he practiced as physician and surgeon for 37 years, specializing in diseases of the chest Dr Woodford was one of the men primarily responsible for the founding of Aldercrest Sanatorium and for many years was medical director of that institution He also served on the staff of the Sisters of Providence Hospital and the Everett General Hospital

Dr Woodford was a Life Member and Fellow of the American College of Chest Physicians, a member of the Snohomish County Medical Society and the Washington State Medical Association Through the years Dr Woodford contributed many articles to the journal "Northwest Medicine" and presented papers at a number of medical meetings

Dr Woodford died December 28, 1947 after a short illness He is survived by his widow, Mrs Catherine Woodford of Everett, Washington, a daughter and a grandson

John E Nelson, M.D , Governor for Washington

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The Role of Trauma in Initial Pneumothorax

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INTRODUCTION

That injury to the lung can occur while the initial pneumothorax is being induced has been recognized since the introduction of this therapeutic procedure Forlanini,^{1 2} Lillingston,³ Murphy,⁴ and Lemke⁵ all commented on the possibility of lung puncture during induction while Brauer,⁶ and Parry Morgan,⁷ were convinced that it was difficult to avoid injury to the lung during the operation.

Nevertheless, the early workers in this field were not unanimous in the recognition of the frequency of lung puncture during initial pneumothorax and the majority believed, with Robinson and Floyd,⁸ that a careful operator could avoid injuring the lung. It has been the optimism of the latter that we have inherited. This is embodied in the widespread present-day acceptance of the puncture technique for initial pneumothorax. At the present time, it is generally accepted that induction of pneumothorax consists of inserting a needle through the chest wall, penetrating the parietal pleura and then, with the two layers of the pleura separated by the needle tip, introducing air into the space between. This is not considered difficult.

This confidence in the simplicity of the operation is not completely shared by a number of clinicians. Fishberg, for example, noted that, "The main difficulty is to pass the needle as far as the costal pleura, puncture it and avoid penetrating the visceral pleura and the lung."⁹ Barnwell, too, complains that, "The hand is not sensitive enough to tell whether the one or both layers of the pleura have been traversed except when the two layers are separated by air or fluid."¹⁰ W. Parry Morgan declared in 1914,

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that *every* initial pneumothorax involved trauma to the lung and, indeed, that it was only because of this injury that it was possible to establish a pneumothorax space at all.⁷ Unfortunately, this hypothesis was not supported by experimental data and, subsequently, other explanations were offered for the "accidents" not infrequently observed during induction of pneumothorax.

Knopf¹¹ regarded excessive collapse at induction as due to the expansion of nitrogen in the warmer confines of the thorax while Balboni¹² regarded it as due to the rupture of an adhesion. Beggs¹³ considered that the loss of support of the chest wall caused weak points in the visceral pleura to give way while Mattill and Jennings¹⁴ suggest that this might happen at a caseous area. Bronfin¹⁵ and Pollack¹⁶ ascribe the accident to the rupture of a bleb. None of the above workers, with the exceptions of Mattill and Jennings, considered pulmonary trauma as an important factor in the etiology of "spontaneous" pneumothorax following initial pneumothorax.

The question remained unsettled until 1936 when one of us (IGT), by clinical experiments, independently reached conclusions that seemed to confirm the hypothesis of Parry Morgan.¹⁷ In each of 17 consecutive patients, the routine method of the pneumothorax induction was employed except for one important modification: *after pleural readings were obtained the needle was withdrawn and no air was given.* In each case subsequent fluoroscopy and roentgenological study showed a pneumothorax space to be present. It was noted, however, that this space was of gradually increasing size for a period of several hours, reaching equilibrium after approximately twelve to twenty-four hours. Analysis of the gases contained in several of these "spontaneously" appearing pneumothorax spaces showed them to be similar to alveolar air in composition. It was concluded, "A small puncture (of the lung) is produced and a variable amount of air is liberated in the pleural space producing a small air pocket. This is the real initial pneumothorax. It is into this pocketed air that we introduce the larger amounts producing by successive refills collapse of the lung." This concept received experimental support recently when Ornstein, Herman and Friedman¹⁸ measured the volume present in pleural cavities 24 hours after the induction of artificial pneumothorax. In each of the five cases studied, "There was an increase in the volume of gas over the volume of air injected at the primary induction of the pneumothorax."

The above quoted studies of Tchertkoff were performed with sharp-pointed pneumothorax needles. Although controversy over the type of needle to be used has abated considerably during the past two decades,¹⁹ it was recognized that the needle used may have influenced the results. Indeed, it has been claimed that

whereas pulmonary trauma might occur with sharp needles, the use of dull points provides a safeguard against lung puncture. Edgar Mayer states that, "With a blunt needle these accidents rarely occur",²⁰ while Burrell claims that, "It is possible to avoid piercing the visceral pleura by using a blunt Riviere needle for the initial operation."²¹ Other workers have similarly advocated a dull needle.²²⁻²⁶

In an attempt to clarify this controversial point, we recently studied 29 patients who were submitted for the induction of initial pneumothorax. In order to eliminate the sharp needle hazard, only dull needles were used (No. 19, short-beveled). As in the previous experimental study, the needle was introduced with the greatest care until pleural readings were obtained. At this point, the needle was withdrawn in 19 cases without giving any air whatsoever and in the remaining 10 cases approximately 100 cc of air was given. *In each of the cases in which pleural readings were obtained a progressively increasing pneumothorax space was demonstrated by fluoroscopy and x-ray* (In two cases, a pneumothorax space could not be clearly seen until pleural readings were obtained a second time). These studies have been reported elsewhere in detail.²⁷

From these experiments, it was obvious that the mere taking of pleural readings (the first step in the routine technique of induction of pneumothorax) will produce a pneumothorax space, whether a sharp or dull needle be used. The gas contained in this pneumothorax space comes from the underlying lung. This is shown by the following facts: 1) Even when no air is introduced into the pleural space during the taking of readings, a pneumothorax space is almost always created. 2) When air is given, the collapse is always greater than might be expected from the amount introduced. 3) The pneumothorax space usually increases progressively over a period of hours. 4) Analysis of the gas that is in the pneumothorax space shows it to be alveolar air. *Thus, every initial pneumothorax is first a traumatic pneumothorax—in every successful initial pneumothorax the space is obtained after puncturing the underlying lung.*

Many facts difficult to explain otherwise become clear when the above findings are kept in mind:

- 1 The difficulty in obtaining a pneumothorax space in atelectatic lungs
- 2 The unusually large collapse so frequently observed in cases of emphysema
- 3 The greater frequency of air embolism during initial pneumothorax

- 4 Instances in which readings cannot be obtained, nor air given, and the attempt considered unsuccessful, but which result in a good pneumothorax space on examination hours later
- 5 Excessive collapse despite introduction of small amounts of air

The recognition that injury to the lung is inevitable during induction of pneumothorax raises the question of whether or not it may be possible to minimize or regulate the trauma produced. That this is not an academic problem is emphasized by the occasional disasters following initial pneumothorax. Harris, in 1915, reported a death following initial pneumothorax, the patient dying 17 hours after induction, with massive collapse.²⁸ In the following decades, other deaths were reported.^{10 13 14 26} In several of these cases, autopsy was performed and in each, rents were present in the lung. But far more frequent than cases ending fatally, are those instances of extensive collapse after initial pneumothorax, in which only immediate deflation has prevented death. The present study, reported herein, was prompted by a desire to devise means of minimizing trauma during induction of initial pneumothorax and thus avoiding dangerous, excessive pulmonary collapse.

Materials and Methods

Eighty-two consecutive patients recommended for pneumothorax therapy at Sea View Hospital were studied. The patients were divided into two groups. In the first group were 36 patients in whom induction was performed with a No 19 dull, short-beveled needle. The induction varied from the usual procedure insofar as *little or no air was given* after pleural readings were taken. If symptoms suggestive of pneumothorax became evident (we found pain referred to the homolateral side of the neck or to the shoulder a reliable indication) the patient was immediately fluoroscoped and if a pneumothorax space was seen, a roentgenogram of the lung, in expiration, was taken at once. Subsequent roentgenograms were taken 3 hours later and the next day. If there were no symptoms "expiration" roentgenograms were routinely taken 3 hours and 24 hours after the pleural readings were obtained. We found early in our work that a relatively "soft" expiration x-ray was more reliable than fluoroscopy. In doubtful cases, therefore, the roentgenogram rather than the fluoroscopic appearance determined the presence and size of a pneumothorax space.

In the second group were 46 patients. In these cases induction was performed with a small needle, using a technique described elsewhere in detail.²⁹ Briefly, a No 24 or 25 needle, attached to

a novocaine-filled syringe, was inserted through the chest wall and as soon as air-bubbles were aspirated, the needle was withdrawn, no air being given. Each patient was then studied in the manner described above.

From the data gathered on fluoroscopy and roentgenograms, an evaluation of the amount of the collapse produced was attempted. This is acknowledged to be arbitrary but since the same criteria were used in all cases, comparative estimations may be considered valid. In 15 patients (7 in group I and 8 in group II) the pleurae were adherent and no pneumothorax space could be obtained despite many attempts. The remaining 29 patients in group I and 38 patients in group II, a total of 67 patients, will be considered consecutive for the purposes of this study.

Results

The results of our investigations indicate that while lung perforation caused by the pneumothorax needle is the basic mechanism of collapse at induction, the degree of collapse is conditioned by the size of the needle used for the initial pneumothorax and other factors discussed below.

A Initial Pneumothorax in Unilateral Disease

Table I shows that the amount of collapse obtained in cases with unilateral disease with minimal or moderate lung involvement, was small. The amount of collapse was nearly twice as great if a large needle was used. In 15 patients in whom pneumothorax was induced with a small needle, the average collapse obtained was approximately 8 per cent while in 11 patients in whom a large needle was used, an average collapse of 15 per cent resulted. However, in none of the cases in this group was the collapse sufficient to produce dyspnoea.

In patients in whom the disease was extensive the difference in the collapse obtained by large and small needles was much more apparent. There were 11 cases of massive unilateral disease. In 7, pneumothorax was induced with a small-gauge needle—the average collapse was 8 per cent and in no case was there dyspnoea. In 4 comparable cases a large needle was used and pleural readings taken, the average collapse was 41 per cent and in 3 of these 4 cases, the patient complained of dyspnoea.

As can be seen from our experiences with patients in whom the disease is unilateral, the collapse will be greater if a large needle is used. This difference will be much more evident if the disease is extensive. It is thus important, in managing cases with massive unilateral involvement to anticipate a certain degree of dyspnoea if a large needle is used for the initial pneumothorax.

TABLE I Initial Pneumothorax in Unilateral Tuberculosis

Pulmonary Collapse With Large Needle	Case	Manometric Readings	Air Introduced	Maximum Collapse Per cent	Dyspnoea	Deflation
A Minimal to moderate unilateral disease	1	Unsatisfactory	None	10		
	2	-9 -6	None	8		
	3	-5 -1	None	15		
	4	Unsatisfactory	None	35		
	5	-14 -8	100 cc	10		
	6	-12 -8	100 cc	5		
	7	-9 -2	None	15		
	8	-9 -6	None	20		
	9	-10 -6	None	5		
	10	-20 -15	None	5		
	11	-10 -4	None	35		
B Extensive unilateral disease		Average collapse	15%	No instance of dyspnoea		
	1	-16 -8	None	25	Moderate	
	2	-14 -8	150 cc	70	Minimal	
	3	Unsatisfactory	None	35	Minimal	
	4	-11 -8	None	35		
Average collapse 41%					Three instances of dyspnoea	

Pulmonary Collapse With Small Needle			
A Minimal to moderate unilateral disease			
1	None	20	
2	None	10	
3	None	5	
4	None	5	
5	None	5	
6	None	5	
7	None	10	
8	None	5	
9	None	15	
10	None	5	
11	None	5	
12	None	5	
13	None	5	
14	None	10	
15	None	10	
Average collapse 8% No instance of dyspnoea			
1	None	5	
2	None	8	
3	None	5	
4	None	5	
5	None	20	
6	None	5	
7	None	7	
Average collapse 8% No instance of dyspnoea			
B Extensive unilateral disease			

Pulmonary Collapse With Small Needle				
A Each lung only moderately involved				
1	None	5		
2	None	5		
3	None	5		
4	None	5		
5	None	5		
6	None	5		
	Average collapse	5%	No instance of dyspnoea	
B Homolateral - moderate Contralateral - extensive				
1	None	20		
2	None	20		
3	None	25		
4	None	40	Moderate	
5	None	35		
6	None	20		
	Average collapse	27%	One instance of dyspnoea	
C Both lungs extensively involved				
1	None	8		
2	None	75	Minimal	
3	None	20		
4	None	80	Marked	Intermittent
	Average collapse	47%	Two instances of dyspnoea	

B Initial Pneumothorax in Bilateral Disease

In bilateral disease the use of the large needle caused dyspnoea and necessitated deflation far more frequently than was the case when a small needle was used. It can be seen from Table II that both the size of the needle and the status of the underlying lung are the major factors in determining the extent of the collapse obtained.

In cases in which the lung to be collapsed is only moderately diseased and in which the contralateral lung is also but moderately involved, the collapse obtained is usually limited. But here, too, needle size influences the extent of the collapse. In 6 bilateral cases, moderate in extent on each side, the collapse obtained with a small needle averaged 5 per cent. In no case did dyspnoea occur. In contrast, in 4 cases in which a large needle was used an average collapse of 16 per cent was obtained and in one case, slight dyspnoea developed.

This difference between the large-gauge and small-gauge needle becomes still more significant in cases in which the contralateral disease is extensive and the lung to be collapsed is only moderately involved. We induced pneumothorax in 6 such cases with a small-gauge needle. The average collapse was 27 per cent and in only one case did dyspnoea develop, it was moderate in nature and did not require deflation. On the other hand, in 8 comparable cases (homolateral moderate, contralateral extensive) the use of the large-gauge needle resulted in an average collapse of 50 per cent, double that of the small needle. Moreover, 6 of the 8 patients became dyspnoeic and 3 of these were so severely dyspnoeic as to



FIGURE 1

FIGURE 2

Figure 1, Case R S. Bilateral disease, with extensive exclusion of the contralateral lung by hydropneumothorax—Figure 2, Case R S. Roentgenogram 4 hours after the induction of pneumothorax with a small-gauge needle (no air given). Collapse never exceeded 30 per cent and dyspnoea did not occur.

require deflation. Figures 1-4 illustrate typical experiences in this group, demonstrating the contrasting degrees of collapse obtained with the large and the small needle.

Finally, in cases in which the disease is extensive in both lungs, induction by any needle is probably dangerous. In our hands, both large and small needles resulted in marked collapse, averaging 50 per cent, and two of the cases we studied required deflation.

Discussion

An analysis of our results indicates that there are two principal factors determining the extent of the collapse in initial pneumothorax—the size of the needle used and the condition of the underlying lung. Since every initial pneumothorax is first a traumatic pneumothorax, it may be expected that a small-gauge needle will produce a smaller collapse, since the smaller the needle, the less the injury to the lung. Actually, our studies confirm this: on the overall picture, the use of the large-gauge needle will result in a collapse twice that found when a small-gauge needle is used.

In most cases with disease of moderate extent, it will make little difference, clinically, whether a small or large needle be used; the patient will rarely become dyspnoeic and will not require deflation. The situation is different in patients with extensive—especially bilateral—disease. These patients, because of their diminished respiratory reserve, are least able to withstand large



FIGURE 3

FIGURE 4

Figure 3 Case H.S. Bilateral disease of similar extent and nature to that of Case R.S. in Figures 1 and 2—Figure 4 In this patient however a large-gauge needle was used for the induction. After pleural readings of -20 on inspiration and -3 on expiration 100 cc of air was introduced. The resulting pneumothorax space showed progressive increase in size and at the time of this roentgenogram 2 hours after initial pneumothorax, showed 30 per cent collapse. The size of the pneumothorax continued to increase and 24 hours after induction with 50 per cent collapse dyspnoea was complained of. Deflation became necessary.

collapse with its attendant diminution in vital capacity. Yet it is precisely in these cases that initial (traumatic) pneumothorax produces the largest collapse. This is true with the small-gauge needle as well as with the large-gauge. However, here the *relatively* smaller collapse obtained with the small-gauge needle becomes clinically important. This is amply illustrated by our experience in this series. We found that dyspnoea was much more common among cases in which induction was done with the large-gauge needle. In 29 cases of induction with the large-gauge needle, there occurred 11 (38 per cent) cases of dyspnoea of which 4 required deflation. In 38 cases in which a small-gauge needle was used, only 3 (8 per cent) had dyspnoea and only one of these required deflation. As can be seen from Tables I and II, dyspnoea occurred mostly in cases with bilateral disease.

Thus it is evident that in cases in which the disease is extensive, it is *almost mandatory, if complications are to be avoided, that a small-gauge needle be used for the initial pneumothorax*. Moreover, even if the disease is not extensive but if the vital capacity is impaired for any reason (severe emphysema, cardiac disease, scoliosis, etc.) it is preferable to use the small-gauge needle in order to obtain a moderate collapse. Figures 5-6 illustrate a deliberate therapeutic application of this principle.

Just as important as needle-size is the condition of the underlying lung. In bilateral cases, as noted above, collapse is twice that found in unilateral disease. And even in unilateral disease



FIGURE 5

FIGURE 6

Figure 5, Case A H Pneumothorax to be induced on the left, in the face of exclusion of the right lung by hydropneumothorax. Because of the special dangers in this type of case, a small needle was recommended for the initial pneumothorax—*Figure 6, Case A H* Roentgenogram 4 hours after the induction of pneumothorax with a small-gauge needle (no air given). This collapse of approximately 20 per cent was the maximum obtained and the patient remained comfortable, with no dyspnoea.

(when the large needle is used) the collapse is much greater when the disease is extensive rather than moderate

An analysis of our cases indicates that it was the extent, rather than the character, of the pulmonary disease which was of importance. It apparently made little difference what the process was which excluded a portion of the lung from respiratory function—caseous infiltration, pulmonary fibrosis, contralateral pneumothorax or thoracoplasty, pleural thickening, hydropneumothorax—each was of significance only insofar as it destroyed or excluded functioning pulmonary parenchyma. It seems to us that the most plausible explanation of this phenomenon lies in the fact that in lungs extensively involved, the remaining functioning parenchyma is constantly active, compensating for the non-functioning areas. Unfortunately, it is precisely these uninvolved areas, distended by compensatory emphysema, constantly active, which we have to choose for the induction of pneumothorax, in order to avoid pleural infection from areas of the lung involved by tuberculosis. And with trauma inevitable during the initial pneumothorax, there is a greater escape of alveolar air, since the emphysematous lung retracts poorly and *the perforation* is kept open by the increased activity of the area. These two circumstances—the altered condition of the remaining functioning parenchyma plus the trauma of the initial pneumothorax—combine to make induction of pneumothorax dangerous in the presence of extensive disease. And since we cannot alter the condition of the lung parenchyma, there remains only the possibility of minimizing the inevitable trauma through the use of the small-gauge needle.

SUMMARY AND CONCLUSIONS

1) *Every* initial pneumothorax is of necessity first a traumatic pneumothorax. The needle inserted into the (potential) pleural space punctures the visceral pleura and air escapes into the pleural space from the lung. This is true irrespective of the type or character of the needle used.

2) Initial manometer readings are those of this traumatically produced pneumothorax, it is into this space that we add air from the pneumothorax apparatus.

3) The trauma to the lung varies with the size of the needle used. Small needles produce small openings into the lung, less air escapes.

4) Several additional factors determine the final size of the pneumothorax. Most important are the existence of contralateral involvement and the status of the underlying lung. If the disease is extensive, the remaining functioning parenchyma shows compensatory emphysema. When such lung is injured, air leakage

is persistent and is aggravated by the constant activity of this functioning part of the lung. Severe and even dangerous dyspnoea may result.

5) Of the two principal factors determining the extent of the traumatic pneumothorax—the condition of the lungs and the size of the needle used—only the latter can be varied. The smaller needle, resulting in less trauma, gives a smaller collapse. In sixty-seven initial pneumothoraces, the collapse obtained with a large (No. 19) needle was approximately twice that noted with a small needle.

6) With moderate pulmonary involvement the size of the needle is of minor importance since excessive collapse and dyspnoea are uncommon.

7) However, in extensive disease the use of a large needle frequently results in marked collapse, often accompanied by severe dyspnoea, requiring deflation. In 16 bilateral cases in which pneumothorax was induced with a small needle, 3 became dyspnoeic, 1 requiring deflation. In 14 similar cases induced with a large needle, 8 became dyspnoeic and 4 of these required deflation.

In patients with extensive disease, the dangers of induction of the initial pneumothorax may be minimized by the use of a small-gauge needle. In bilateral cases, its use appears essential if a manageable collapse is to be obtained.

RESUMEN Y CONCLUSIONES

1) Todo neumotórax inicial es necesariamente un neumotórax traumático al principio. La aguja que se introduce en el espacio pleural (potencial) agujerea la pleura visceral y permite el escape de aire del pulmón al espacio pleural. Sucede esto no importa cual sea el tipo o la clase de aguja que se emplee.

2) Las indicaciones iniciales del manómetro se deben al neumotórax producido por este traumatismo, y es a este espacio al que añadimos aire mediante el aparato de neumotórax.

3) El traumatismo causado al pulmón varía de acuerdo con el tamaño de la aguja empleada. Agujas pequeñas producen agujeros pequeños en el pulmón y menos aire se escapa.

4) Varios factores adicionales determinan el tamaño final del neumotórax. Los más importantes son la existencia de lesiones contralaterales y el estado del pulmón subyacente. Si la enfermedad es extensa, el parénquima funcional restante sufre un enfisema compensatorio. Cuando se hiere a tal pulmón, el escape de aire es persistente y lo agrava la actividad constante de esta parte funcional del pulmón. Puede resultar disnea grave y hasta peligrosa.

5) De los dos factores principales que determinan el tamaño

del neumotórax traumático—la condición de los pulmones y el tamaño de la aguja empleada—sólo el último puede ser variado. Las agujas más pequeñas causan menos traumatismo y, por consiguiente, ocasionan colapsos más pequeños. En sesenta y siete neumotórax iniciales, el colapso obtenido con una aguja grande (No 19) fue aproximadamente el doble del que se notó con una aguja pequeña.

6) Con una lesión pulmonar moderada el tamaño de la aguja es de poca importancia, ya que demasiado colapso y disnea son raros en estos casos.

7) Sin embargo, cuando la enfermedad es extensa el empleo de una aguja grande resulta frecuentemente en marcado colapso, acompañado a menudo de grave disnea que requiere desinflación. En 16 casos bilaterales en los que se inició el neumotórax con una aguja pequeña, 3 tuvieron disnea y hubo que desinflar a uno. En 14 casos semejantes iniciados con una aguja grande, 8 tuvieron disnea y fue necesario desinflar a 4.

En pacientes con lesiones extensas, es posible reducir al mínimo los peligros del neumotórax inicial mediante el uso de una aguja pequeña. Su empleo parece ser esencial en casos bilaterales si se desea obtener un colapso manejable.

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Indications for Pulmonary Resection for Tuberculosis Both by Lobectomy and Pneumonectomy*

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INTRODUCTION

The actual role of pulmonary resection in the treatment of tuberculosis is one of the most disputed questions in the surgical therapy of this disease. With the great improvements in the surgical management of lobectomy and pneumonectomy, together with a better understanding of the physiology of the thoracic organs, and the use of powerful antibiotics, surgeons are encouraged as never before to strike directly at the problem of extirpating the diseased portions of the lung. Yet despite these advances, pulmonary resection still remains a formidable procedure, one not to be lightly recommended. The authors believe that pulmonary resection should not be advised in competition to the standard collapse measures used in the treatment of pulmonary tuberculosis, but that resection is to be performed when these measures have failed or obviously will not succeed. The purpose of this discussion is to present a practical consideration of the problem, based on the management of over a thousand cases of pulmonary tuberculosis by various surgical measures during the recent years.

General Considerations

With the present day surgical technique, the operative results in pulmonary resection for pulmonary tuberculosis are far superior to those of even a few years ago. The important points in these improved methods are discussed later, under "Surgical Technique." Yet, in reviewing our cases and the reports in the recent literature, we are impressed with the fact that following pulmonary resection for tuberculosis, the percentage of cures where the patient has a negative sputum on culture varies from 40 to 45 per cent while the overall mortality ranges from 14 to 38 per cent. If we compare these results with those following thoracoplasty, which is the procedure that has given the best results when medical measures including pneumothorax have failed, a striking contrast is seen.

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The present day postoperative mortality for thoracoplasty is less than 2 per cent and from 65 to 80 per cent cures are reported in the literature from many clinics. It is apparent, therefore, despite the great strides that have been made in reducing the serious complications in pulmonary resection, that the following considerations concerning resection must be carefully weighed

- 1) The mortality rate and morbidity are much higher following resection than following thoracoplasty

- 2) Contralateral and ipsilateral spreads or re-inactivations are much more frequent

- 3) Bronchial fistula and empyema are much more frequent

- 4) If empyema develops or a tuberculous pleural effusion persists for some time, the remaining lung beneath will be to a greater or lesser degree immobilized with loss of function. Even though no such complication develops, some reduction in function occurs because of the adherence which usually takes place between the chest wall and the remaining lobe or lobes

- 5) Less frequently, than by thoracoplasty, does the sputum or material obtained by gastric lavage become free of tubercle bacilli and remain so following lobectomy and pneumonectomy

Without doubt, lung resection is a valuable adjunct in our therapeutic contest against pulmonary tuberculosis. It will increase in its worth as technical difficulties are overcome, however we are still of the opinion that thoracoplasty is to be preferred for many of the cases reported in the literature, where lung resection is now being employed

Pulmonary tuberculosis is essentially a bilateral disease. The aim in combating it is to preserve as much pulmonary tissue as possible, contingent upon the arrest of the tuberculous process. Accordingly, when applicable, "reversible" immobilizing or collapsing measures are employed in preference to "irreversible" ones. These "reversible" measures are intrapleural pneumothorax, pneumonolysis, temporary diaphragmatic paralysis, pneumoperitoneum, and extrapleural pneumothorax. If, after some, but not prolonged observation, these procedures are not successful, or are not justified, then "irreversible" procedures are considered. When thoracoplasty probably, even possibly, may be followed by sputum conversion, we feel it is indicated rather than lobe or lung resection. The thoracoplasty must affect the maximum collapse of the lung possible, and should include complete removal of the upper ribs, transverse processes plus a "lysis" of the lung, when indicated. The collapse should be continued by the removal of a sufficient number of ribs to insure effective closure of the pulmonary cavities. Thoracoplasty, if unsuccessful, may then be followed by removal of the offending pulmonary tissue.

Indications for Pulmonary Resection

Our main indication for pulmonary resection is the failure of thoracoplasty to control the disease. If, following thoracoplasty, a residual cavity is demonstrated by Potter-Bucky films or planograms to be the source of the tubercle bacilli in the sputum, then some form of surgery must be considered. However, before deciding upon pulmonary resection, the following possibilities should be eliminated

- 1) Revision thoracoplasty
- 2) The formation of an extrapleural space and possible insertion of some sort of pack, or plombage
- 3) Cavity drainage
- 4) In some cases, no further surgery

If revision thoracoplasty may increase the collapse of involved lung sufficiently to obliterate a nearly closed cavity and thus affect sputum conversion, it certainly should be tried. Revision thoracoplasty is most often the procedure of choice when thoracoplasty has failed. If it is performed in graded stages, the mortality is low. If there is no absolute contra-indication, such as a bronchial stenosis, the results are most encouraging.

The development of an intra or extrapleural space directly over the residual cavity, with or without an apicolysis, followed by the introduction of wax or some other form of pack has been carried out by us in more than 30 cases. Approximately 50 per cent were successful in converting sputum negative to culture.

External drainage of a residual cavity after an unsuccessful thoracoplasty, maintaining drainage by means of a pedicled skin flap has also resulted in about 50 per cent apparent cures. However, revision thoracoplasty is preferred to either plombage or cavity drainage. The failures of the latter are very disheartening to both patients and doctors. Success is assured only after weeks or months of prolonged hospitalization, frequent dressings and discomfort to the patient.

If the remaining cavity is small and if the sputum is positive, only occasionally by culture, if the patient is intelligent and responsible, in certain instances it is permissible, in our opinion, to advise against further surgery with the definite understanding that such a person check regularly with a physician skilled in recognizing premonitory or early signs of trouble.

Thoracoplasty fails primarily as a result of four main factors namely, tension cavities, endobronchial disease, cavities located close to the spine and bronchiectatic cavities.

1) *Tension cavities* The behavior of a tuberculous lung cavity is unpredictable. Its persistence depends in a very large measure

on the relationship of the cavity to its bronchus or bronchi. Because of viscid or inspissated secretions, or necrosing tissue in the cavity at the bronchial opening or within the bronchus itself, because of bronchial disease either ulcerative or cicatricial, because of edema of the bronchial walls and local or widespread bronchial spasm, because of softening and kinking of bronchial walls proximal to the cavity with which it is joined, a check-valve mechanism may develop in that bronchus or at the broncho-cavitary junction.

The enlargement of the bronchial lumen that occurs in a normal bronchus during inspiration, probably takes place in some degree in an edematous one especially during the act of coughing. With expiration, as the bronchial lumen narrows, some air may be trapped. As this phenomenon continues, a tension cavity develops. Undoubtedly other factors lead to the accumulation of air within tuberculous cavities producing positive pressure within them.

Unfortunately, we cannot determine the cause in any given case of the check-valve mechanism. Similarly, we are unable to anticipate what may lead to its elimination. Under no treatment whatsoever, a cavity may increase or decrease astonishingly in size in a matter of days or even hours. With pneumothorax, a cavity may increase 100 per cent or more in size as compared with the condition before pneumothorax was instituted. It may at once disappear when the pneumothorax has been abandoned and re-expansion of the lung takes place.

Immediately following "phrenic crush," a large tension cavity may disappear perhaps to reopen when the diaphragmatic leaf returns to active motion. With the so-called "Monaldi drainage," a cavity may seem to be closed, only to return when the catheter draining the cavity is extruded.

And so it is with thoracoplasty. One can never be sure except by trial whether a tension cavity, perhaps a large one, will disappear with sputum conversion. Nor can we be confident that a small thin-walled cavity near the periphery (where prognosis for closure by thoracoplasty should be excellent) will not persist, even increase in size, during the course of the thoracoplastic stages. Statements to patients concerning thoracoplastic results must therefore be guarded for we are unable to predict broncho-cavity behavior.

Throughout all these weeks or months of treatment, success has depended upon the production of an advantageous alteration in the broncho-cavitary relationship that would afford a constantly adequate communication between the cavity or cavities under treatment and their bronchi. Since we cannot as yet anticipate when, if at all, such a desirable relationship may take place, we advise the much less serious thoracoplasty before re-

commending lobectomy It should be remembered that at operation, pathologic changes may be found that make the proposed lobectomy not feasible and necessitate a complete removal of the lung Thus lobectomy or pneumonectomy are indicated when thoracoplasty is unsuccessful in closing a tension cavity (Case 1)

2) *Endobronchial disease* Endobronchial tuberculosis is not necessarily an indication for lobe or lung removal The mild forms of tuberculous bronchitis showing only hyperemia and edema of the bronchial mucosa in no way change the general indication for treatment Similarly, a submucosal tuberculous lesion which is more of a pathologic than a clinical diagnosis, does not constitute an indication for pulmonary extirpation Many surgeons consider tuberculous ulceration an indication for lobectomy or pneumonectomy, as the prognosis with thoracoplasty in this type lesion was not good Up until the past year, we have treated these lesions with cauterization of silver nitrate and proceeded with the thoracoplasty Frequently, the resultant cicatricial stenosis of the

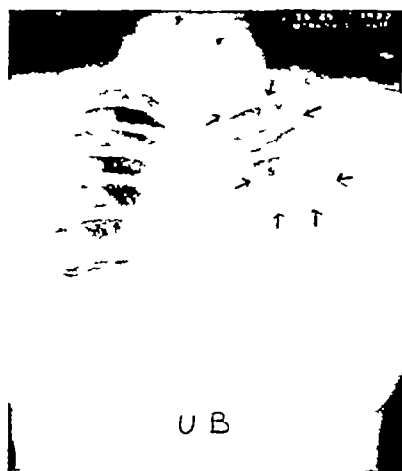


FIGURE 1A



FIGURE 1B

CASE 1 This 23 year old female gave a history of cough productive of large amounts of sputum fever and chronic fatigue of two years duration. Pneumothorax had been tried unsuccessfully The patient was toxic and dyspnoeic with a daily fever of 102 degrees Figure 1A shows a huge tension cavity of the left upper lobe of the lung with scattered foci on the right Because the patient had no demonstrable bronchostenosis by bronchoscopic examination and because of the instability of the pulmonary lesion a thoracoplasty was performed Figure 1B shows persistent cavity of the upper lobe of the left lung following thoracoplasty and a revision of the thoracoplasty The right sided pulmonary lesion was now stable enough to permit lobectomy of the left upper lobe The patient has been well for over one year following this procedure This case was not a suitable risk for lobectomy when the thoracoplasty was performed The decrease in fever toxicity and the amount of sputum along with the stabilization of the right sided lesion made the patient a satisfactory subject for pulmonary resection

bronchus necessitated ultimate lung removal. However, the use of streptomycin for the treatment of tuberculous ulcers of the bronchus, as described later in this paper, seems to be the treatment of choice.

Cicatricial stenosis of the bronchus which results from a tuberculous tracheal bronchitis, is a very important indication for pulmonary resection. However, with gentle dilation of the narrowed portion of the bronchus, drainage may be established so that the thoracoplasty may be successful in closing the pulmonary cavity. In some instances, adequate collapse of the pulmonary cavities and ultimate conversion of the sputum, was effected even though drainage from the bronchus was not well established before the thoracoplasty was undertaken. Since the operative risk is far less, and since the spread to the contralateral lung is unusual with thoracoplasty, we believe that this surgical procedure



FIGURE 2

CASE 2 A male 33 years old was treated for pulmonary tuberculosis for ten years. There had been cyclic attacks of productive cough and fever during this period of time. Pneumothorax and oleothorax had been unsuccessful in controlling the right sided pulmonary lesion. Bronchoscopy revealed a tuberculous fibrous stenosis of the right upper lobe branch bronchus. Drainage of the right upper lobe was effected by bronchoscopic dilations of the stenosis and thoracoplasty resulted in apparent control of the upper lobe disease. However, one year later the symptoms of bronchial obstruction again occurred and bronchoscopy showed that the right main bronchus was now almost completely obstructed with a fibrous stenosis. The x-ray now showed cavitation and atelectasis of the entire right lung (Fig 2). Because of progressive bronchostenosis, thoracoplasty had failed and pneumonectomy was performed. The patient is now well.

should be given a fair trial before attempting pulmonary resection. If in a case with bronchial stenosis, complete collapse of the lung is obtained with intrapleural pneumothorax but the sputum remains positive, then it is manifest that a thoracoplasty will secure no greater collapse and a "primary pneumonectomy" is indicated. If thoracoplasty has been tried and has failed, then pulmonary resection is the procedure of choice (Case 2).

3) *When a cavity lies close to the mediastinum and hilum* Such a cavity, so disadvantageously located, has seldom been closed by either intrapleural pneumothorax or extrapleural pneumothorax. We do not feel warranted, however, in recommending primary lobectomy under such conditions since it is by no means rare to obtain cavity obliteration and sputum conversion by thoracoplasty alone.

If, however, the cavity is thin-walled, especially if recent in development, even though it be located close to the mediastinum near the hilum, its closure may follow either of the reversible procedures first mentioned. If these are not successful, thoracoplasty often is followed by sputum conversion.

Lobe removal, then, is indicated if no other measure has availed (Case 3). It should again be emphasized that at operation it is often far better to abandon the attempt to remove a lobe if the presence of disease in the adjoining lobe (only discovered at operation) precludes the excision of all tuberculosis except by removal of the entire lung.

4) *Bronchiectasis* Thoracoplasty in a patient with pulmonary tuberculosis may fail to control a recurrent hemoptysis. Frequently the cause of the hemorrhage is found in bronchiectatic cavitation. In some instances it is extremely difficult to ascertain the exact site of the hemorrhage, particularly if there is bilateral pulmonary fibrosis. Before considering resection, the surgeon must exercise great care to ascertain the exact source of the pulmonary bleeding. Some patients can tell exactly the site of a hemoptysis. Bronchograms are helpful if it is possible to fill the bronchiectatic dilatation responsible for the hemorrhage. However, if the bronchogram does not prove satisfactory, then a bronchoscopy must be performed when the patient is hemorrhaging so that the source of the hemorrhage can be accurately determined. If the findings at bronchoscopy are equivocal, then this procedure must be repeated until the surgeon is certain of the particular lobe that is involved. Then, even though the bronchograms and planograms have not been conclusive, lobectomy may be carried out. However, mild degrees of bronchiectasis and asymptomatic types do not constitute an indication for resection. Thus, the persistence of some cough and expectoration following thoracoplasty, and even an occasional

blood-streaking of the sputum do not demand removal of the offending pulmonary tissue

Indications for "Primary Resection"

1) *Lower and middle lobe cavities* If pneumothorax is not immediately successful in closing the cavity, it is not at once abandoned. Based on the premise described above, the persistence is likely to be due to inadequate bronchial drainage from the cavity or cavities present. We have found it worth while therefore, to change in as many ways as possible lines of stress and strain within the lung, hoping by so doing to facilitate the maintenance of a constant and sufficient bronchial opening from the cavity or cavities. Accordingly, instead of abandoning the pneumothorax pocket, temporary diaphragmatic paralysis is added. If this mechanical alteration has not an important effect on the cavity,

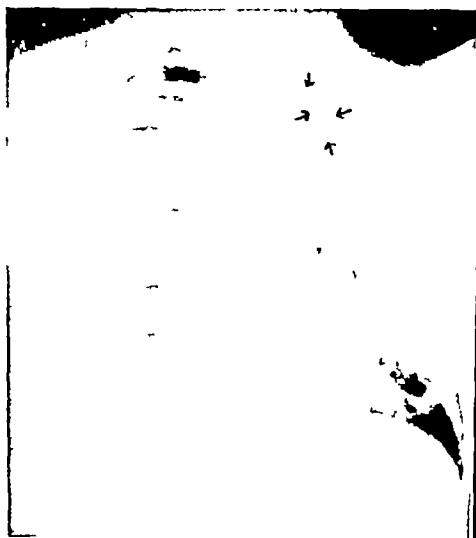


FIGURE 3

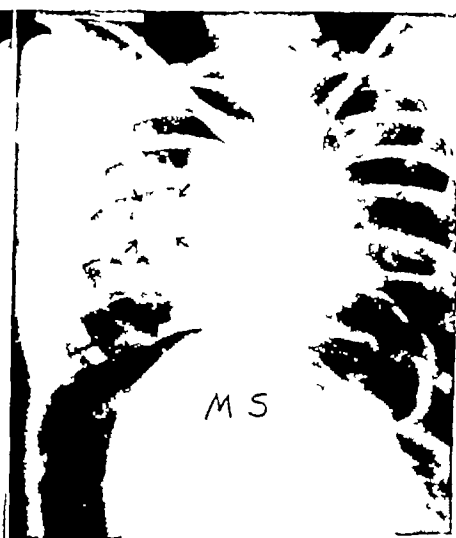


FIGURE 4

CASE 3 This 47 year old male had pulmonary tuberculosis for seven years during which time he had alternately worked and rested. Following an unsuccessful pneumothorax a paraffine plombage was performed to collapse the cavity of the left upper lobe of the lung. The cavity remained open and a subsequent thoracoplasty after removal of the paraffine also failed to collapse the cavity. X-ray (Fig 3) shows a persistent cavity close to the spine following thoracoplasty. Revision thoracoplasty seemed to be contraindicated because of the position of the cavity and a lobectomy was performed. The patient has been well for six years.

CASE 4 A 28 year old female had a productive cough with positive sputum for a period of three years. First a right pneumothorax and then a pneumoperitoneum with a temporary phrenic crushing were unsuccessful in closing a cavity of the right lower lobe. Figure 4 shows the cavity persisting in the right lower lung field following these procedures. Primary lobectomy of the right lower lobe was indicated, as there have been very poor results with thoracoplasty for lower lobe cavities. Thoracoplasty, which was not performed soon after the lobectomy, had to be subsequently done to control upper lobe disease.

pneumoperitoneum is instituted. If still no encouraging improvement follows, pneumothorax refills are stopped. If, after all these measures, closure is not obtained, we believe that removal of the lower lobe is indicated (Case 4).

2) *Blocked cavities and tuberculomata* Experience has repeatedly demonstrated that expulsion of tuberculous material from a previously blocked cavity, often leading to spread of the disease to other lobes, is notoriously prone to occur. The presence of such a shadow, particularly if the patient complains of a mildly disturbing non-productive cough, constitutes a definite indication for lobectomy without a preceding trial thoracoplasty. There exists, of course, the possibility that the mass is carcinomatous in nature.



FIGURE 5



FIGURE 6

CASE 5 This 54 year old female complained of a slight cough and weakness of six months duration along with some gastrointestinal complaints in the form of nausea, flatulence and abdominal distress. The sputum was negative for acid fast bacilli on culture. After the production of a diagnostic pneumothorax, thoracoscopy showed no tubercles on the pleura and some sort of a mass in the upper lobe of the right lung. Because bronchogenic carcinoma could not be ruled out, the right upper lobe was resected. A tuberculoma was proven by pathological examination. The patient has been well for two years and this seems to vindicate the indication of resection of a pulmonary tuberculoma.

CASE 6 A female aged 41 years complained of a dry cough and fever of several weeks duration. Bronchoscopy showed no tumor and the sputum obtained by this procedure was negative for acid fast bacilli on culture. We advised removal of the right upper lobe of the lung, but the patient had few symptoms and refused surgery. Six months later the lesion broke down with a bronchogenic spread of the tuberculosis to both lower lobes of the lung. An extensive thoracoplasty was necessary to control the right sided disease. It seems likely that resection of the lobe of the lung containing this blocked cavity, before the lesion had broken into the bronchial tree, would have prevented the diffuse spread of infection to the other lobes. Figure 6 shows the shadow in the right upper lobe of the lung which remained static for a period of 6 months before breaking into the bronchus.

Whether tuberculous or carcinomatous therefore, the early removal of the lesion is indicated (Cases 5 and 6)

3) *Persistent bronchostenosis* We have previously stated that if a cicatricial stenosis of the bronchus may be dilated successfully with bronchoscopic treatments, so that the resultant operation gives adequate drainage from the effected lobe or lobes, then thoracoplasty has a good chance of being successful. However, if it is impossible to secure a satisfactory airway by bronchoscopic dilations, then the thoracoplasty is doomed to failure. Often, for technical reasons, such as the angle at which an upper lobe bronchus comes off the main stem bronchus, it is impossible to adequately dilate a visible bronchial stenosis. In these instances where it is a foregone conclusion that thoracoplasty will not



FIGURE 7



FIGURE 8

CASE 7 This 50 year old female had pulmonary tuberculosis diagnosed 23 years previously. After a year in the sanatorium she remained well for 17 years. Following a hemoptysis a pneumothorax was instituted on the left and although she rested for the next six years, the sputum remained positive for tubercle bacilli. X-ray (Fig 7) demonstrated a "ground glass" appearance of the almost completely collapsed left lung. Because of the non-dilatable stenosis of the bronchus, proper drainage could not be established. This resulted in an "intrinsic atelectasis" of the lung, in which although the collapse of the lung was considerable (certainly more than could be expected by thoracoplasty) the sputum was strongly positive for acid fast bacilli on direct smear. Because no other form of therapy offered a reasonable chance of cure, primary pneumonectomy was indicated. She has remained well for 2½ years.

CASE 8 A male aged 49 years had suffered from pulmonary tuberculosis for 21 years. He had first been treated by rest, then a left sided pneumothorax which was discontinued because of the formation of fluid. For the 10 years preceding our treatment of the patient there had been increasing weakness, harassing cough and the raising of several ounces of purulent sputum daily. The sputum was intermittently positive. A bronchogram revealed total bronchiectasis of the left lung—with shift of the heart and mediastinum to the left. It was obvious that thoracoplasty would be ineffectual and a total pneumonectomy was performed. He has been well for over 1 year.

succeed, primary pulmonary resection is the procedure of choice. In other instances the stenosis is not visible with the bronchoscope but the bronchostenosis may be suspected by the homogeneous "ground glass" appearance of the lobe or lung in the x-ray. This is particularly apparent when a pneumothorax has been performed and this "ground glass" atelectasis of the lung is seen. We use the term "intrinsic atelectasis" for these cases to indicate its bronchial origin. In these cases, continuation of the pneumothorax is not likely to close the cavity, while abandoning the pneumothorax may be unsuccessful for the same reason, namely, because of the bronchostenosis. If high negative pressures are used, then fluid may develop, which is also undesirable. The expansion of the lung is desirable if it can be accomplished and cavity closure is secured during re-expansion in some cases. However, when the collapse of the lung is greater than that possible with a thoracoplasty and the sputum remains positive and when expansion is not readily obtainable, then primary pulmonary resection is the treatment of choice (Case 7).

4) *Bronchiectasis* Bronchiectatic dilatations are frequently the aftermath of extensive tuberculous involvement of the pulmonary parenchyma. In these cases, a low grade tuberculous process may be present in the bronchiectatic sacculations and the sputum is often negative for acid fast bacilli except when an acute respiratory infection is present. Recurrent hemoptysis are common. Occasionally the tuberculous etiology of this condition may be overlooked in what appears to be a straightforward case of non-specific bronchiectasis, and the true nature of the pathology found only when microscopic sections are made of the resected pulmonary tissue following a lobectomy. A careful history, study of previous chest roentgenograms, and repeated sputum cultures will usually establish the tuberculous etiology. Primary pulmonary resection is indicated in these cases of bronchiectasis with definite symptoms or positive sputum, provided active pulmonary tuberculosis in the remaining lobes can be ruled out (Case 8).

Physiological Considerations

In studying any patient for either lobectomy or pneumonectomy, due regard must be paid to the cardiopulmonary reserve. If the patient will be made a respiratory cripple or go into pulmonary decompensation following resection of a lobe or lung, it is obvious that the operation is contra-indicated. The functional capacity of the contralateral lung and remaining lobe is, in most instances, the deciding factor. Bronchspirometry with differential oxygen consumption and blood gas analysis, though desirable, are generally not available and not yet standardized. We have relied on a

general clinical evaluation of the patient, together with simple breathing tests at rest or with mild exercise, the vital capacity and breath holding time. It is important to estimate the function of the remaining pulmonary tissue in the contralateral lung, in case of pneumonectomy and in the additional remaining lobes in a proposed lobectomy. With an intended lobectomy, it should be definitely decided before the operation whether or not the patient will stand a pneumonectomy, for lesions not seen on the chest roentgenogram are often found at operation which will make pneumonectomy necessary for the ultimate cure of the patient. Of course, if the lung is totally involved, then it can be safely assumed that the function of respiration is being carried on by the opposite lung.

The pulmonary function is made up of two main parts: (1) The action of the diaphragm and chest wall and (2) the capacity of the underlying lung to receive and exchange oxygen and CO_2 . Diaphragmatic paralysis, often the result of an ill-advised permanent phrenic operation, or the immobility of the diaphragm from pleural adhesion, greatly embarrasses the functioning of the lungs. A previous pleurisy may prove most serious if it limits the movements of the chest wall. In this connection, the development of pleural fluid in any pneumothorax space must be considered as serious, if future optimum function of the underlying lung is needed. The physiological capacity of the lung is also dependent upon the amount of normal pulmonary tissue that is present. Thus, the degree of fibrosis, calcification and emphysema present in the lung, should be carefully evaluated. There are usually some of these changes present in most cases of pulmonary tuberculosis. Where pulmonary function is already reduced by some of these complications, any mediastinal shift, kinking of the trachea or main bronchus, or bronchial occlusion further impedes the ingress and egress of air to the lung.

Although the vital capacity is only a relative test of pulmonary function, any reduction below 1500 cc for the average patient must be viewed with concern. Similarly, a breath holding time less than 15 seconds denotes a poor pulmonary reserve. Cardiac embarrassment, although detected by the usual tests, must be suspected if displacement of the mediastinum is marked. Amyloidosis, which may be diagnosed by the congo-red test, often produces marked alterations in the physiology of the patient. Care must be taken in the planning of the pre and postoperative treatment of these cases.

Low pulmonary capacity may contra-indicate a lobectomy, which otherwise would be the ideal therapeutic procedure. In these cases the surgeon is justified in attempting the other measures men-

tioned previously, namely, cavity drainage or the formation of an extrapleural space with the insertion of some sort of pack. These two procedures have less adverse effect on pulmonary reserve than revision thoracoplasty, and so can be used for the more desperate cases. Revision thoracoplasty, on the other hand, can be used for those that are not a suitable risk for resection.

Pathological Considerations

The type of pulmonary tuberculosis and the actual pathological changes in the lungs are of primary concern. For the most part, the reports in the literature have not accurately classified the cases according to the actual pathologic pulmonary findings. Yet the results must be evaluated in light of the pathologic pulmonary lesions if standardized criteria for pulmonary resections are to be established. The simplest classification embodies the character of the pulmonary lesion and the method of spread. It is important to consider whether or not the tuberculous process is predominantly caseating or fibroid, and whether the disease is acute or chronic and spread through the bronchial tree. The stability of the pulmonary lesion, the broncho-cavitary relationship (as previously discussed), and amount and character of the sputum are important mitigating factors. Tuberculous lesions showing lymphogenous and hematogenous dissemination are usually bilateral and progressive. To expect a good late result from pulmonary resection in a case of pulmonary tuberculosis with protracted hematogenous dissemination, is out of the question. Up to the present time, the emphasis has been on the mere survival after the operation. However, with the lowered early mortality rate, attention should be turned to correlating the late results with the pathologic condition in the lungs.

Preparation of the Patient for Pulmonary Resection

Once the advisability for pulmonary resection has been decided upon, it behooves the surgeon not only to pick the proper time to perform the operation but also to get the patient in as satisfactory condition as possible to undergo surgery.

A Selection of time for performing operation. In general, the patients with advancing pulmonary lesions are not fit subjects for lobectomy and pneumonectomy. Even with the aid of the powerful antibiotic, streptomycin, the lesion in the contralateral lung should be static or arrested. It is desirable that any lesion of the contralateral lung be quiescent for a period of at least a year before resection is carried out. We have performed lobectomy and pneumonectomy where the contralateral lesion had been inactive for less than a year with a recrudescence of these lesions.

All of the standard criteria for the determination of "activity" in tuberculosis should be used. The temperature, pulse and respiration, blood counts and sedimentation rates, if followed over a period of time, offer important clues as to the activity of any given lesion. Patients who are steadily losing weight, generally have progressive tuberculosis. Investigation of the gastro-intestinal or genito-urinary tract should be made if the symptoms point to involvement of these organs. Of course, some activity is present in the diseased portion of the lung to be removed. This makes differentiation of the exact source of the symptoms of an active pulmonary lesion most difficult. Serial x-rays are probably the greatest help in showing which lesions of the lungs are responsible for the signs of toxicity in any given patient. However, in some instances it is impossible to decide. We believe that many so-called "spreads" of pulmonary tuberculosis following surgery, are really due to contralateral lesions or ipsilateral ones which have had undiagnosed activity or have been re-activated following resection.

It is well known that pulmonary tuberculosis is a cyclic disease, characterized by exacerbations and remissions. Care should be taken to perform the resection during a remission, if possible. It is true that exceptions to this rule exist. For example, if a tension cavity with a fluid level is present, then considerable evidence of activity of the tuberculous lesion may be found which is directly referable to the retention of infected secretions. Likewise, if there is a bronchial stenosis and the obstruction cannot be relieved by bronchoscopy, then it may be necessary to disregard the signs of infection that are present and proceed with the pulmonary resection.

B Treatment of ulcerative tuberculous tracheal bronchitis The presence of active ulcerating tuberculous tracheal bronchitis should be considered now as a contra-indication to resection and surgery postponed until the tuberculous ulceration has healed. The results of Brewer and Bogen¹ in treating ulcerative tuberculous lesions of the trachea and bronchi with intramuscular and "Aeresol" streptomycin have been most encouraging in showing prompt healing of these lesions. Although the amount of scar tissue after the streptomycin treatment seemed less than that with the conventional cauterization with silver nitrate, stenoses were not prevented. Frequently, the tuberculous ulceration of the bronchus occurs at a site where amputation and closure of the bronchial stump would be desirable at surgery. The chances of healing the bronchial stump are immeasurably improved, if the ulcerative lesion is healed before surgery is undertaken. The surgeon is no longer justified in performing pulmonary resection in a patient with active tuberculous ulceration of the bronchus, without first

giving a thorough course of streptomycin treatment. However, if only hyperemia and edema of the bronchial mucosa is present, which is either a very early stage of tuberculous bronchitis or non-specific infection, then it is safe to proceed with the resection.

If a healed bronchial stenosis is present, and there is a "back-up" of secretions beyond the stenosis, causing fever and the signs of acute infection, then it is wise to promote drainage through the obstructed portion of the bronchus by gentle dilatations of the stricture. Once the secondary infection is decreased and the fever and toxicity is ameliorated by the establishment of adequate bronchial drainage, resection may be undertaken.

C General measures Most cases of pulmonary tuberculosis have been treated with long periods of bed rest before they are considered as candidates for lobectomy and pneumonectomy. Such long periods of inactivity result in a lessened tonus of the cardiovascular system. It is desirable, therefore, to get the patient out of bed for a short time each day for a period of from two to three weeks before surgery in order that the tonus of the cardiovascular system may be restored to a near normal level. Anemia is to be corrected before the patient leaves the sanitarium, by diet and the administration of iron and liver in sufficient amounts and blood transfusions if necessary. If the blood proteins are low, high protein diet and intravenous protein preparations may be given. Wound healing is also dependent upon a normal vitamin C blood level. We are accustomed to administering from 100 mgms to 500 mgms of Ascorbutic acid in addition to other vitamins for the week preceding surgery.

To minimize non-specific bronchial and pulmonary infections, after operation, we routinely administer penicillin by the intramuscular and "aerosol" techniques 5 to 7 days before surgery, as well as during the postoperative period. Early reports make it seem worth while also to administer streptomycin intramuscularly so that bronchogenic spread and possible re-activation of latent pulmonary lesions may be minimized.

Operative Technique

A Position on the table The position of the patient on the operating table is of great importance, as every effort must be made to prevent the flow of purulent secretions from the lobe or lobes to be removed, to the unoperated lung. We believe that the steep Trendelenberg position, with the chest at a 45 degree angle with the horizontal, will greatly decrease the contra-lateral spread of sputum from the affected lung. The superiority of this position over the conventional prone one is readily recognized. Overholt

has used a "face down" position which, in his hands, has reduced contralateral spread from 19 to 10 per cent

B Anesthesia The importance of a particular anesthetic agent or agents has received undue emphasis in the current medical literature Pentothal, cyclopropane, nitrous oxide, ethylene, and ether all have had their advocates We believe that it is the method of employment and the skill of the anesthetist in administering any given agent that is really important Steady, deep narcosis must be maintained so that frequent bronchial and tracheal aspirations and the occasional changes in the intrapulmonary pressure can be carried out without the danger of violent cough or bronchospasm which may be followed by a bronchogenic spread Our anesthetist employs pentothal or cyclopropane for induction and local anesthesia to aid in the rapid and smooth passage of the intratracheal tube We have found ether the most satisfactory agent for the maintenance of long anesthesia The apnea technique is avoided and anesthesia is maintained so that respiration is carried on partially by the patient, assisted by the anesthetist This type of respiration, or "compensated respiration" is best for these long operations

The flow of citrated blood into a vein is started through a large needle or cannula, when the surgeon begins the operation and does not cease until the surgical procedure is completed The amount of transfusion administered should equal the amount of blood lost Even though the operation has been particularly sanguinous due to the large number of vascular adhesions that were present, if the blood loss is immediately replaced, the patient stands a good chance of leaving the operating table with a systolic blood pressure above 100 and a pulse scarcely more rapid than before surgery

D Surgical approach (1) Approach for primary pulmonary resection The long posterolateral incision over the entire fifth rib, after the manner of Crawford offers an excellent exposure of the entire pleural cavity This approach is also used for upper lobe lobectomy For lower lobe lobectomy, a long segment of the sixth rib is removed subperiosteally from the transverse process around to the midclavicular line In our experience these postero-lateral approaches are far superior to the anterior entrance into the pleural cavity

2) Approach if a thoracoplasty has been performed previously The exposure of the lung is much more difficult than when the chest wall is intact Usually the thoracoplasty incision is re-entered and swung forward to the midclavicular line at about the level of the fifth rib If possible, it is wise to resect the uppermost unresected rib (providing this is not lower than the seventh rib)

to gain access to the pleural cavity The incision is then carried upward, posteriorly, paralleling the spine to gain exposure of the apex of the lung Often what amounts to a revision thoracoplasty, with removal of a large plaque of regenerated bone has to be performed before the lung is exposed The surgeon who persists in the removal of the lung following this tedious and difficult entrance into the pleural cavity readily appreciates why it has been widely recommended to perform the lobectomy or pneumonectomy in pulmonary tuberculosis without first trying a thoracoplasty The actual pleural space, after thoracoplasty, is smaller, thus the dissection is more difficult for there is less room for manipulation of the lung and the hilar structures are less easily exposed

E Points in surgical technique Certain points in surgical technique will be found helpful in assuring the successful removal of a tuberculous lung and ultimate cure of the patient Utmost gentleness in manipulation of the lung must be employed if rupture of tuberculous cavities and the expression of infected material into the bronchial tree are to be avoided The lung must be gently separated from the chest wall and mediastinum by sharp dissection to minimize injury to the pulmonary tissue If bleeding is encountered, hot compresses will generally control the oozing of blood, however, suture ligatures of fine silk may be necessary to control the hemorrhage from the surface of the lung or parietal pleura From the point of view of avoidance of bronchogenic spread, the sooner the main bronchus of the lobe or lung to be removed is exposed and closed, the better It may be advisable to place a temporary ligature around the bronchus before the final closure is accomplished To expose the hilar vessels, one must first begin with a wide mediastinal separation It is wise to have three sides of a main pulmonary vessel under direct vision so that digital control of bleeding is possible

In dissecting out the bronchus, great care is taken to preserve the blood supply right down to the point of actual division of the bronchial wall A right-angle gall bladder clamp is used to clamp the bronchus It is applied lightly so that it does not traumatize the bronchus sufficiently to impair healing The use of a clamp is advocated because it prevents the entrance of blood into the bronchial tree and the escape of secretions and gasses into the pleural cavity Furthermore, in difficult cases after bronchial section, the lung may be freed and retracted so that short pulmonary vessels are put on a stretch and ligated with safety A second similar hemostat is placed distally to prevent contamination from the lung that is to be removed Cutting between the two hemostats with a scalpel, the bronchus is divided No cauter-

izing chemicals are used, as they destroy more tissue than infecting organisms. We believe that 007 tantalum wire on a half curved swedged needle of the same diameter is the suture material of choice as it produces no tissue reaction, holds the walls permanently together, and the fine swedged needle makes no larger opening in the bronchial wall than the diameter of the suture material. Three simple sutures, placed into the end of the bronchus around the clamp, are tied after removing the clamp. At intervals of approximately 1 mm apart, other single simple sutures are placed through the two layers of the cut bronchus to draw the membranous portion to the cartilaginous ring. It is important to turn in the cut ends of the sutures so that there is no danger of tearing an adjacent vessel from the sharp ends of the tantalum wire. An elaborate burying of the bronchial stump is not necessary. This technique is the simplest of all those mentioned in the literature. There is no other method that offers a higher percentage of successful closures.

Before closing the chest wall, the fifth intercostal nerve is resected and the fourth to the ninth intercostal nerves are crushed with a fine hemostat to prevent postoperative pain. This has proven to be a most important part of the surgical technique, for the avoidance of pain after operation allows the patient to cough freely and raise whatever sputum is present within the bronchial tree. The amount of opiates that are necessary to keep the patient comfortable are greatly decreased by this procedure and the injurious side effects from over-sedation are thus eliminated. The actual closure of the chest wall is effected in layers, using running and interrupted chromic catgut sutures.

In the case of lobectomy, both an anterior and a posterior intercostal drainage tube is employed. These tubes are connected with a closed under-water drainage system. The use of these tubes allows prompt expansion of the remaining lobe. In the case of pneumonectomies, done primarily, no drainage tubes are employed, however, if the pneumonectomy follows a thoracoplasty, the actual volume of the thoracic cavity on the operated side may be extremely small, and a temporary drainage tube is most helpful in preventing mediastinal compressions. These intercostal tubes are clamped off during the trip to the ward.

Postoperative Care

A Immediately, in the operating room Once the wound is closed and a firm dressing has been fixed in place, the patient is turned cautiously from his side to the back. This turning must be done slowly to prevent sudden mediastinal shift, which might -

result in pulmonary or cardiac arrest. The success of the surgery depends upon sending the patient back to his room with the remaining lobes of the lung free of aspirated blood and secretion. The lungs are therefore carefully checked by auscultation with a stethoscope and any signs of rales or retained secretions are dealt with at once. Since a catheter passed through the intratracheal tube may be left in for a longer period of time than the bronchoscope, it is preferred for the aspiration of fluids that may take some time to drain from the smaller bronchi into the main stem bronchus. Thus, with the catheter in place in the main stem bronchus, the patient may be slowly turned so that the lung with rales is uppermost and secretions from the peripheral part of the lung may have an opportunity to gravitate into the stem bronchus. We have found that the more diligent we are in aspirating even the slightest amounts of fluid material from the bronchial tree, the fewer postoperative spreads of the pulmonary tuberculosis and the fewer instances of non-specific pneumonitis will be encountered. Bronchoscopy is used if clots block a main bronchus or the catheter cannot be passed into a particular bronchus.

B Care on returning to the room. Oxygen should be immediately available, to be given by the nasal catheter technique. The patient is placed in Trendelenberg position until he is awake, coughing, and the blood pressure stabilized. Carbon dioxide is administered every hour or half hour, over a period from six to eight hours to promote deep breathing, and then every three hours. It is much better to have the patient cough up his own sputum, however, if he fails in this attempt, then the surgeon should not hesitate to pass a catheter into the trachea and main bronchi by the nasal approach, after the manner of Haight.

Demerol in doses of 100 mgms is used to control the pain. Whatever narcotic is used postoperatively, the first injection given after return from surgery should be only one-half or one-third the usual dose, to avoid depression of the respiratory center before complete recovery has taken place. If intercostal drainage tubes have been used to drain the pleural cavity, then several hours after returning to the room following surgery, 100,000 units of penicillin and 1 gram streptomycin are injected into the tube which is then clamped off for a period of six hours. Sips of water by mouth are permitted after the cessation of nausea and the patient is usually rapidly placed on a soft diet. Fluids are permitted up to 2500 cubic centimeters per day by either the intravenous or oral route. Vitamin C, one of the important factors in wound healing, is given in doses of 500 mgms bid, intramuscularly. Postoperative anemia is handled by prompt blood transfusions, so that the hemoglobin and red blood cell count are maintained.

at normal levels. The intercostal drainage tubes usually cease to function in 24 to 48 hours, and so may be removed. Further accumulations of pleural fluid can be aspirated with the needle and syringe. In the case of a primary pneumonectomy, where no drainage tubes are employed, daily aspirations should be made for the first four or five days so that the mediastinum may be kept at the midline. At the time of the aspiration, penicillin and streptomycin may be introduced into the pleural cavity. Intramuscular penicillin may be stopped the second week after surgery and streptomycin in 3 to 6 weeks following the operation, unless otherwise indicated. During the early postoperative period, the patient is encouraged to move about in bed, to sit up, to move his legs, and shoulder girdle muscles so that the circulation is adequate and no muscle stiffness results and phlebostasis and phlebothrombosis are prevented.

C Late care Because we have done few lobectomies and pneumonectomies without first performing a thoracoplasty, the problem of the post-resection thoracoplasty has not often arisen in our experience. If a lobe has been removed without a primary thoracoplasty, then the chest wall should be collapsed within six weeks following the lobectomy, so that overexpansion of the remaining lobe will not result in a possible re-activation of a latent pulmonary tuberculous lesion in this lobe. In the pneumonectomies for pulmonary tuberculosis, where a thoracoplasty has not been performed previously, the mediastinum is frequently so rigidly fixed that a secondary thoracoplasty following the pneumonectomy may not be necessary, however, if there is a tendency for the mediastinum to shift toward the resected side, or for a mediastinal herniation of the remaining lung to take place, then a thoracoplasty should be promptly performed.

In general, we have insisted on six months bed rest following lobectomy or pneumonectomy for pulmonary tuberculosis. We have thought that this bed rest was necessary because pulmonary tuberculosis is usually bilateral, and that any possible activity in the remaining lobes of the lung should be thoroughly controlled before exercise was permitted. Pleural complications are probably minimized by this prolonged period of bed rest. After the patient returns to the sanitarium, he may be allowed the privilege of one visit to a bathroom or commode daily. The comfort that this affords the patient, we believe, offsets the possible disadvantage of being out of bed for this one period of time. After the sputum has been negative for a period of six months, the patient is started on a period of graded activity and exercise similar to the regimen following thoracoplasty.

Results

Surgical statistics concerning pulmonary resection, compiled from a number of clinics have little value. There are too many variable factors. Not sufficient data is published by the various authors to permit accurate classification as to the character of tuberculous lesions, the pathology of entrance of the tubercle bacilli, the manner of spread, etc. The selection of cases, the skill and method of the anesthetist, the operative technique and the postoperative care, and various other factors differ widely. Manifestly, it is of more value to report separately the results obtained in individual series than to combine them. Despite the variable factors, above mentioned, the uniformity of results is striking. In the authors' series of 26 cases of lobectomy, there are 46.2 per cent apparently well with negative sputum, 30.7 per cent alive with positive sputum and 23 per cent total deaths, of which 11.5 per cent were early postoperative deaths and 11.5 per cent were late deaths. Results following 14 cases of pneumonectomy are 41.7 per cent apparently well with negative sputum, 22.5 per cent alive with positive sputum and 35.7 per cent total deaths, of which 17.7 per cent occurred in the early postoperative period and 18.1 per cent in the late period. Our present operative technique was not used in all of these cases. As other surgeons have discovered, we anticipate a lowered mortality if the operative principles outlined in this communication are followed. Overholt² reports 42.7 per cent of 69 cases treated by lobectomy as apparently well with negative sputum, 18.9 per cent are alive with positive sputum, and total deaths, 14.7 per cent. Following 127 cases of pneumonectomy, there are 42.9 per cent apparently well with negative sputum, 14.6 per cent alive with positive sputum, whereas the total deaths are 28.3 per cent. In Sweet's³ series of 27 lobectomies, 48.5 per cent are apparently well with negative sputum, 25.9 per cent are alive with positive sputum and total deaths are 25.9 per cent. His results following pneumonectomy in 36 cases are 44.4 per cent apparently well with negative sputum, 16.6 per cent alive with positive sputum and 38.8 per cent total deaths.

These figures are of value only in a general way. Time alone will give the final answer to the question of the types of cases for which resection is indicated. In our series, with few exceptions, we operated only when thoracoplasty had failed. This represents an extremely hopeless group of cases in which a cure could not be obtained by any other present day method of treatment.

SUMMARY

1) Pulmonary resection has a definite place in the surgical therapy of pulmonary tuberculosis in salvaging otherwise hope-

less cases

2) With the exceptions cited, we prefer thoracoplasty to lobectomy and pneumonectomy in the treatment of pulmonary tuberculosis. This point of view is based on the fact that the mortality from thoracoplasty is considerably lower than pulmonary resection and to date, the late results of resection seem to offer no better chance of permanent cure.

3) When thoracoplasty fails, the following measures are considered before performing pulmonary resection:

- (1) Revision thoracoplasty
- (2) Creation of extrapleural space and packing
- (3) Cavity drainage
- (4) In some cases, no further surgery

4) Primary pulmonary resection is preferred to thoracoplasty for

- (1) Lower and middle lobe cavities
- (2) Tuberculomata and blocked cavities
- (3) Persistent bronchostenosis
- (4) Symptomatic bronchiectasis

5) From the point of view of the pathological pulmonary changes, the type of disease most amenable to lobectomy and pneumonectomy is that characterized by fibroid and caseating lesions of the lung in which the mode of spread is principally by way of the bronchus. Since the prognosis following thoracoplasty in this type of lesion is also good, it is unusual that the surgeon is confronted with the problem of primary pulmonary resection.

6) Primarily, hematogenous or lymphogenous disseminated pulmonary tuberculosis is a contra-indication to resection, as these types of disease are progressive and removal of one part of the lung does not alter the course of the lesions in the remaining part of the lung.

7) If thoracoplasty is unsuccessful, then revision thoracoplasty, plombage, and cavity drainage should be considered before lobectomy or pneumonectomy is performed. Pulmonary resection is to be preferred to cavity drainage, if the pulmonary capacity of the patient permits.

8) In selecting any case for lobectomy or pneumonectomy, the surgeon must be certain that the patient has sufficient pulmonary reserve. Contralateral pleural thickening and diaphragmatic paralysis, along with fibrosis, calcification, and emphysema of the lung are the most important conditions in lowering the patient's breathing capacity.

9) In the surgical management of over 1,000 cases of pulmonary tuberculosis, we have performed lobectomy and pneumonectomy in 40 cases with early and late mortality of 27.5 per cent. In

approximately an equal number of cases, resection was indicated but not performed for various reasons. This represents a very hopeless group of cases where for the most part, thoracoplasty had failed, and no other treatment would cure.

10) Lobectomy and pneumonectomy are indicated in many patients where thoracoplasty has failed or obviously will not succeed. The actual number of patients upon whom it is possible to perform pulmonary resection is greatly reduced because of these factors: (1) contralateral tuberculosis, (2) instability of the contralateral lesion, and (3) low pulmonary reserve.

11) We are by no means satisfied that the indications we have presented will stand the test of time. Our point of view lies somewhere between the eager advocates for pulmonary resection, whose enthusiasm has not yet been supported by satisfactory long-time results, and those who roundly condemn lobectomy and pneumonectomy for pulmonary tuberculosis.

12) It is becoming steadily more evident that it is not technical skill alone that will lead to a higher percentage of permanent arrests in pulmonary tuberculosis. The basic tendency of the disease in each particular case is variable. Thus, the more able we become in recognizing the type of pulmonary involvement, the more accurately we will place lobectomy and pneumonectomy in their proper relationship with other therapeutic procedures.

RESUMEN

1) La resección pulmonar tiene una posición bien definida en la terapia quirúrgica de la tuberculosis pulmonar en salvar a casos que de otra manera serían incurables.

2) Con las excepciones citadas preferimos la toracoplastia a la lobectomía y neumonectomía en el tratamiento de la tuberculosis pulmonar. Se basa este punto de vista en el hecho de que la mortalidad de la toracoplastia es considerablemente más baja que la de la resección pulmonar y en que, hasta la fecha, los resultados alejados de la resección no parecen ofrecer mejores oportunidades de curaciones permanentes.

3) Cuando fracasa la toracoplastia se consideran las siguientes medidas antes de llevarse a cabo una resección pulmonar:

- (1) Toracoplastia de revisión
- (2) Creación de un espacio extrapleural y empaque
- (3) Canalización de la caverna
- (4) En algunos casos, ninguna otra operación

4) Se prefiere la resección pulmonar primitiva a la toracoplastia en:

- (1) Cavernas en el lóbulo inferior y medio
- (2) Tuberculomas y cavernas bloqueadas

(3) Broncoestenosis persistente

(4) Bronquiectasia sintomática

5) Desde el punto de vista de las alteraciones patológicas del pulmón, el tipo de enfermedad más tratable por lobectomía y neumonectomía es el que está caracterizado por lesiones pulmonares fibrosas y caseosas en las que la manera principal de propagación es por las vías bronquiales. Pero desde que el pronóstico que sigue a la toracoplastia en este tipo de lesión es también bueno, es raro que el cirujano se encare con el problema de la resección pulmonar primitiva en estos casos.

6) La tuberculosis pulmonar diseminada, principalmente hematógena o linfógena, es una contraindicación a la resección, pues estos tipos de enfermedad son progresivos y la extirpación de una parte del pulmón no altera el curso de las lesiones en la parte restante del pulmón.

7) Si fracasa la toracoplastia, se deben considerar la toracoplastia de revisión, el plombaje y la canalización de la caverna antes de llevar a cabo una lobectomía o neumonectomía. Se debe preferir la resección pulmonar a la canalización de la caverna si la capacidad pulmonar del paciente así lo permite.

8) Al seleccionar cualquier caso para lobectomía o neumonectomía, el cirujano debe estar seguro de que el paciente tiene suficiente reserva pulmonar. Espesamiento pleural y parálisis diafragmática contralaterales, junto con fibrosis, calcificación y enfisema pulmonares, son las condiciones más importantes que disminuyen la capacidad respiratoria del paciente.

9) En el tratamiento quirúrgico de más de 1000 casos de tuberculosis pulmonar hemos llevado a cabo lobectomías o neumonectomías en 40 casos, con una mortalidad temprana y tardía del 27.5 por ciento. En un número de casos aproximadamente igual, se indicaba la resección pero no se llevó a cabo por varias razones. Representa éste un grupo de casos muy desesperanzados, en la mayor parte de los cuales había fracasado la toracoplastia, y que no eran curables por ningún otro tratamiento.

10) Se indican la lobectomía y la neumonectomía en muchos pacientes en los que ha fracasado la toracoplastia o es evidente que no resultará satisfactoria. El verdadero número de pacientes en los que es posible ejecutar una resección pulmonar queda muy reducido por los factores siguientes: (1) tuberculosis contralateral, (2) inestabilidad de la lesión contralateral y (3) baja reserva pulmonar.

11) No estamos seguros de que las indicaciones que hemos presentado resistirán la prueba del tiempo. Nuestro punto de vista no coincide ni con los que abogan vehementemente por la resección pulmonar, cuyo entusiasmo no ha sido apoyado todavía por

resultados satisfactorios por suficiente tiempo, ni con aquellos que francamente condenan la lobectomía y neumonectomía en el tratamiento de la tuberculosis pulmonar

12) Se evidencia cada vez más que no es la destreza técnica sola lo que producirá un porcentaje más alto de detenciones permanentes de la tuberculosis pulmonar. La tendencia fundamental de la enfermedad varía en cada paciente. De manera, pues, que mientras más desarrollemos la habilidad de reconocer el tipo de lesión pulmonar, con más exactitud podremos colocar la lobectomía y neumonectomía en su propia relación con otros procedimientos terapéuticos

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D I S C U S S I O N

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The improvement in the technical procedures of lobectomy and pneumonectomy has resulted in a steady decline in the mortality rate. The use of antibiotics, whole blood replacement and measures to prevent a bronchogenic spread of the disease are as important as the surgical procedure. The ability to perform a successful lobectomy or pneumonectomy does not of itself constitute an indication for such surgical procedures.

Pulmonary tuberculosis is usually not a localized disease, therefore extirpative surgery or local removal, except in selected cases cannot be expected to produce a cure. When considered as a method of correcting or overcoming the complications of tuberculosis, extirpative surgery would seem to have a wider application.

It has been stated by Dr. Brewer that resection is not a competitive form of treatment, but should be used when the standard collapse methods have failed or obviously will fail. I believe that most of us are in general agreement with this statement and it is only in those "anticipated failures" where the absolute indications are lacking that any disagreement occurs.

The indications for resection are not absolute although they are

becoming clearer We now limit our resections to those patients falling into three groups (1) Tuberculoma, (2) Thoracoplasty failures and (3) Anticipated failures of which the chief ones are (a) inaccessible cavities and (b) marked bronchial stenosis

In our small series of 20 cases only 40 per cent of the patients are alive and well, three years after resection This does not compare favorably with our thoracoplasty statistics I believe the continued observation of these patients will lead to more definite indications for resections

I want to congratulate Dr Brewer upon his excellent paper

Benign Pulmonary Histoplasmosis*

A Case Report With a Brief Review of the Literature

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Until recent years histoplasmosis has been considered a fairly rare and always fatal disease, however, evidence is steadily accumulating that a benign phase of the disease exists

Darling was the first to describe the disease and reported three cases (1906,¹ 1908,² 1909³) He suggested that the organism responsible for the pseudotuberculous lesions in the lungs be called *Histoplasma capsulatum* and that the disease be called histoplasmosis DeMonbreun,⁴ in studying the first case of histoplasmosis reported from Tennessee by Dodd and Tompkins,⁵ was the first to describe the cultural characteristics of the organism and, by satisfying Koch's postulate, proved that the fungus is responsible for the disease histoplasmosis

There are several excellent reviews of the literature on histoplasmosis, therefore, we will mention only those articles that seem pertinent to this report Those further interested may refer to the excellent reviews of Meleney,⁶ Iams, Tenen and Flanagan,⁷ Parsons and Zarafonitis,⁸ and Moore and Jorstad⁹

Cases have been reported from Europe, the Southwest Pacific, South America, Central America and nearly every section of the United States The greatest number of reported cases has been from the mid-western area of this country

The last known survey of the literature on histoplasmosis is by Ziegler¹⁰ who reported a case from Pennsylvania in June of 1946 His case brought the number of reported cases to 79 Since then we know of at least 19 additional cases being published,¹ including the one reported here These additional cases are tabulated (See Table 1)

The reported cases have nearly all been generalized or military in type Those cases that were not fatal have shown localized

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¹No doubt there are other reported cases that have not come to our attention

lesions usually characterized by ulceration of skin or mucous membranes. As yet little is known of the pathogenesis of this disease. However, the probability is that it will parallel tuberculosis as closely as it does clinically.

The symptomatology varies according to the organs that are involved. Since the pulmonary disease closely resembles tuberculosis of the lungs, it is natural that the symptoms of pulmonary histoplasmosis are similar. Cough, purulent sputum, chest pain, fever and night sweats have been reported as symptoms.

The published work of Palmer^{22, 24} and of Christle and Peterson²³ shows that the area with a high incidence of tuberculin negative, histoplasmin positive persons with pulmonary calcifications corresponds fairly well with the area in the United States from which most of the cases of histoplasmosis have been reported.

Parsons and Zarafonetis⁸ have shown that the disease is more frequent in males than in females, about 3½ to 1 in all ages, and about 7 to 1 in persons over 10 years of age. While they have

TABLE I
Cases Reported Since Ziegler's Review in June, 1946

Case	Reported by	From	Date Published	
80	Davis & Neff - 12	Missouri	Feb	1946
81	Davis & Neff - 12	Missouri	Feb	1946
82	McLeod, Emmons, Ross & Burk - 13	Virginia	March	1946
83	McLeod, Emmons, Ross & Burk - 13	Virginia	March	1946
84	Madureira - 14	Brazil	May	1946
85	Madureira - 14	Brazil	May	1946
86	Madureira - 14	Brazil	May	1946
87	Madureira - 14	Brazil	May	1946
88	Kuzma & Schuster - 15	Wisconsin	June	1946
89	Swan & Finnegan - 16	Wisconsin	Aug	1946
90	Seabury & Drygas - 17	Michigan	Aug	1946
91	Seabury & Drygas - 17	Michigan	Aug	1946
92	Iams, Keith & Weed - 7	Minnesota	Dec	1946
93	Mider, Smith & Bray - 11	Virginia	Jan	1947
94	Conklin & Hankins - 18	Nebraska	March	1947
95	Curtis & Cawley - 20	Michigan	April	1947
96	Thomas & Mitchell - 19	Illinois	May	1947
97	Lam & Price - 21	Honolulu	May-June	1947
98	Johnson & Batson	Alabama	?	1947

shown that every organ has been involved in one case or another, those most frequently found involved at autopsy are in the order of their frequency, the "spleen, liver, visceral lymph nodes, lungs, bone marrow, oral mucosa, adrenals, gastrointestinal tract, peripheral lymph nodes, kidneys and larynx" Vegetative endocarditis was found in three patients They also have shown that "the most common signs and symptoms in the order of their decreasing frequency are fever, hypochromic anemia, hepatomegaly, splenomegaly and lymphadenopathy"

In view of these facts, it would seem that one should consider histoplasmosis in any case in which there are various combinations of fever, nodular or ulcerative lesions of the skin or mucous membranes, generalized lymphadenopathy, hepatosplenomegaly, anemia and leukopenia, and low blood pressure With pulmonary disease resembling tuberculosis but with negative sputum and negative tuberculin tests one certainly must include histoplasmosis in the differential diagnoses This is particularly true in the geographical areas with a high incidence of pulmonary calcifications in persons with negative tuberculin tests and positive histoplasmin tests It goes without saying that one cannot diagnose a disease without first thinking of it

Skin testing with histoplasmin and old tuberculin should be done on all patients suspected of having histoplasmosis When possible, one should also skin test the patient with coccidioidin and blastomycin in order to rule out possible cross immunologic responses A positive histoplasmin test should not be interpreted as being diagnostic but is highly suggestive of antecedent infection with *H capsulatum* or another immunologically related organism

The diagnosis may be confirmed by culture or by microscopic demonstration of the organism in tissue preparations The yeast cell phase of the fungus may at times be seen by microscopic examination of bone marrow or peripheral blood that has been stained with Wright's or Giemsa's stain These yeast cells appear singly or in groups as small oval bodies surrounded by a capsule and located within the cytoplasm of large phagocytic cells It is also possible to demonstrate these organisms in smears of material from ulcerative lesions, biopsied lymph nodes, or visceral punctures *H capsulatum* may be cultured from any of the above material by inoculation onto blood agar and Sabouraud's medium Cultures should be allowed to grow in duplicate at room temperature and at 37 C At incubator temperature yeast cell colonies may appear, whereas at room temperature the organism always grows in the mycelial phase The latter culture should not be discarded until the appearance of tuberculate chlamydospores, which establishes the mycologic diagnosis It is important that

all cultures be sealed to prevent drying and that cultures not be discarded as negative until a period of 6 weeks has elapsed

When culturing sputum one should mix penicillin and streptomycin with the material to a final concentration of 1000 units of each antibiotic per cc. The mixture should incubate at 37° C for 1 hour after which time it is inoculated onto culture media. The addition of penicillin and streptomycin suppresses the growth of common bacterial contaminants.

The growing number of reported cases of histoplasmosis and the close resemblance of its pulmonary type to tuberculosis makes the case we are about to present most important. Clinically, this case had all the earmarks of pulmonary tuberculosis but, as will be shown, such a diagnosis could not be established.

M J C, a 64 year old farmer residing in North Alabama, was admitted to Vanderbilt Hospital on July 16, 1947. He stated that, except for pain in his left sacroiliac region, and a chronic nonproductive morning cough which had begun following pneumonia and typhoid fever at age 11, he was well until 10 months prior to admission. At this time his cough became more severe and was productive of small amounts of purulent sputum. He had chest pain which he was unable to describe but which



covered an area extending from the apex of the left axilla to the left base between the anterior and posterior axillary lines. This pain was not influenced by exercise or breathing. There was also an associated pain in the region of the left elbow.

The sputum was greenish yellow, odorless and tasteless, and at no time contained blood. The 24 hour output was 2 or 3 tablespoonfuls. During 6 months preceding admission he developed paroxysms of coughing both day and night. He had no night sweats. He was easily fatigued and lost 7 pounds despite a good appetite. There is no history of tuberculosis in his family and no history of contact with that disease. His family and personal history are otherwise unimportant. His previous health and illness review is not remarkable. His system review reveals traumatic blindness in the right eye since age 20, a history of carious teeth, a right inguinal hernia and no venereal disease.

Physical examination revealed a well developed and nourished white man apparently of stated age. His skin was dry and slightly scaly and without ulcers or eruptions. He had a corneal opacity in the right eye with which he could only distinguish light. His oral hygiene was poor. The teeth were markedly carious and there was moderate gingivitis without ulceration. His thorax showed slight asymmetry with flattening on the left where there was some lagging with inspiration. The percussion note was impaired slightly over the left upper chest where the breath sounds were suppressed and bronchovesicular. There were no signs of cavitation and there were no rales. Otherwise examination revealed only a moderately enlarged, smooth prostate without tenderness and slight clubbing of the fingers.

The remainder of the examination was not pertinent to this report. His temperature, pulse and respiration curves were normal during the 16 days hospitalization.

The x-ray was reported as follows: "There is a cavity in the left apex overlying the anterior tip of the first rib and in the first anterior interspace which measures about 3 x 4 cm with considerable pleural thickening along the chest wall in the apex extending downward along the lateral chest wall. Each costophrenic angle shows some blunting. There are fibrotic infiltrations in the right apex and in the right lung field which extend across the right mid-lung field into the periphery. Scattered through each lung field are multiple small rounded calcified lesions. Heart is within normal limits as to size and shape. Impression: Pulmonary tuberculosis with cavitation in the left apex."

Laboratory Data Urine cloudy. Specific gravity 1.017. Reaction acid, no albumin, no sugar. Microscopic examination showed an occasional W.B.C. but no R.B.C. or casts. Blood R.B.C. 4,350,000, W.B.C. 6,400, hgb 12 gm, differential normal. Kahn negative. N.P.N. 33, sugar 84, total serum protein 7.34, serum albumin 4.41, serum globulin 2.93. Stools showed no blood, ova or parasites. Sputa on three direct smears were negative for tubercle bacilli. Gastric washings negative for acid-fast bacilli. Guinea pig inoculation with gastric washings negative for tubercle bacilli. Blood culture negative.

O.T. Skin test (Montoux) 0.1 mg and 10 mg negative. Coccidioidin 10 mg negative. Histoplasmin 0.1 cc of 1:100 dilution 4+ (approximately 12½ cm in diameter).

Because of the positive histoplasmin test, the negative sputum and the negative tuberculin tests histoplasmosis was suspected. The patient's

sputum was cultured by the technique described above * Many colonies of *H. capsulatum* appeared in approximately 10 days and tuberculate chlamydospores were identified after 6 weeks

No treatment was administered to this patient other than by symptomatic and supportive measures including bed rest and a high caloric, high vitamin diet

He was discharged from the hospital after marked reduction of cough but returned in 3 months for reevaluation of his condition This examination was made November 1 He had regained 7 pounds but his productive cough was essentially unchanged Physical examination was the same as previously and the x-ray of his chest was unchanged

We did not treat the patient with any of the antimony or diamidine preparations because they have not yet proved of value and because he was responding favorably to the bed rest and general supportive measures

This is a case of pulmonary histoplasmosis without demonstrable evidence of involvement of other organs It is further evidence that a benign type of histoplasmosis exists, adding to the mounting evidence compiled by Christie and Peterson ^{25a b c d} Exception may be taken to calling this a benign case but whether benign or mild it appears to be a link between the cases showing calcifications with positive histoplasmin and negative tuberculin tests, and those showing overwhelming generalized infection

We are privileged to mention two cases reported by Christie and Peterson that point toward benign phases of this disease, primarily considered universally fatal

The first^{25a} is that of a well developed and nourished 10 month old infant with bilateral subdural hematoma who died following an attempt at excision of the membrane At autopsy a small calcified nodule 3 or 4 mm in diameter was found in the lower lobe of each lung The hilus glands were enlarged but showed no caseation Microscopic sections were made of the calcified areas and the enlarged hilus lymph glands in both lungs and no tubercle bacilli were found, however, they did show tubercle-like lesions which contained large mononuclear cells The fungus was cultured from the calcified lesions

Another case^{25a} was that of an 8 month old infant with hydrocephalus, meningocele, and spina-bifida There was no history of contact with tuberculosis At autopsy sections from the lung through a tubercle in the periphery of an area of interstitial pneumonitis revealed large mononuclear cells in which the yeast cells of *H. capsulatum* were found

There have been other cases^{25a} in which the principal disease was unrelated to histoplasmosis and in which equally positive evidence of benign histoplasmosis was found Seventeen cases of histoplasmosis have been diagnosed at the Vanderbilt University Hospital and 6, including the one here reported, have been recorded in the literature This non-disseminated phase of the

*The isolation and identification of the organism was carried out by Dr David McVickar

disease no doubt exists in other endemic areas, therefore, it would seem likely that other cases have been recognized but not reported, also there are probably many that have not been suspected or recognized

SUMMARY

- 1) A brief summary of the pertinent literature on histoplasmosis has been presented
- 2) The symptomatology and diagnostic procedures have been discussed
- 3) Nineteen recently reported cases of histoplasmosis have been tabulated
- 4) A case of benign or mild pulmonary histoplasmosis has been presented

RESUMEN

- 1) Se ha presentado un breve resumen de la literatura pertinente a la histoplasmosis
- 2) Se han discutido la sintomatología y los procedimientos para el diagnóstico
- 3) Se han arreglado en forma de tabla diecinueve casos de histoplasmosis sobre los cuales se ha informado recientemente
- 4) Se ha presentado un caso de histoplasmosis pulmonar leve o benigna

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Pitfalls in Dealing with Cancer Statistics, Especially as Related to Cancer of the Lung*

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It is a great honor to be asked to address such a distinguished body of physicians, and I am grateful to your program chairman for this invitation, because it not only gives me an opportunity of sharing with you some of my ideas about collecting and analysing cancer data, but also because it has furnished me a vacation here with my husband, and both of us are very grateful to Dr Banyai for this opportunity

Although my title might lead you to think that my address will be mathematical, that is not the case I have not the training in statistics to deal with the subject in a highly complex manner, I shall point out what are common fallacies in our treatment of cancer data I should say that 90 per cent of statistical analysis is the application of common sense The greatest source of error in both the collection and analysis of the data is a lack of proper controls The point at which this is first noted is in the information inquired for in the clinical history We attempt to elicit facts which we consider as significant in the past history of the patient, and the significance relates entirely to what we think are causative factors in producing the cancer Inasmuch as we do not know the cause of most cancers it is obvious that what we ask for is what we think is contributory It is small wonder then that we find our ideas about contributing factors confirmed We are not likely to correct any mistakes in our ideas nor are we apt to add new ideas

As an example of this type of error, we might look at the cancer forms put out by the American College of Surgeons for cancer in various parts of the body The patient with rectal cancer is asked about constipation, hemorrhoids, etc the patient with skin cancer is asked about his exposure to the weather, the patient with breast cancer is asked about abnormalties in lactation history, and the patient with cervical cancer is queried as to the number of child-

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ren, and miscarriages that she has had But the woman with breast cancer is not asked about her constipation, and the man with cancer of the prostate is not asked about exposure to the weather The result is that we find that a given percentage of rectal cancer patients have a history of constipation, but we do not know whether that is higher, lower or the same as the percentage of prostatic cancer patients who are constipated If we find a history of breast infections in a certain percentage of women with breast cancer we do not know whether that is greater, less or identical with the percentage of breast infections in women who have cervical or gastric cancer Our methods of collecting data on the incidence of conditions which may be thought to be productive of any given type of cancer tend to confirm us in the ideas we already had but they do not lead us to make new discoveries, and they do not offer us a control as to the significance of the information we collect

In order to have our data and the deductions made from them of value, we must know more than the incidence of any factor in the history of our particular group of patients, we must know the incidence of the same factor in patients not suffering from the disease we are studying We may find that 95 per cent or 99 per cent of our lung cancer patients smoke, but what does that mean if we find that 95 or 99 per cent of all men smoke? Ninety per cent of women with cervical cancer are said to have had children What percentage of women without cervical cancer have had children? I once heard a man make the statement that he thought that some chemical in tobacco was productive of cervical cancer, because every woman who had come to him in his practice with cervical cancer worked in a cigar factory at some time in her life On inquiry, I found that all the women in the town in which he practiced worked in a cigar factory at some time in their lives, so that it could equally well be claimed that rolling tobacco leaves was the cause of fractures, babies, indigestion and corns in the women of that community

One sees papers published to the effect that in a given district lung cancer is oftenest found in the workers in the pottery factories, in other districts, lung cancer will be said to occur almost exclusively in the coal miners, etc Accompanying this should be a statement as to what percentage of the male workers in the first community were from the pottery plants, in the second, what percentage of the male workers in the district were coal miners As long as we do not control our data, by asking the same questions of those not suffering from the disease as are asked of the patients with the disease, we cannot legitimately assume that the positive history of a trait has any significance I ask of all the cancer

patients I interview, no matter where their cancer is located, the same questions, omitting only the menstrual and obstetrical data when interviewing male patients I inquired of a man with prostatic cancer whether he was unduly exposed to the weather. He said that he was an engineer on a freight train, and that for thirty years he had been exposed to wind and sleet, rain and sun, with his head and shoulders out of the cab window. But he had no skin cancer. Had I elicited that history from a man with cancer of the skin of the face, it would have at once been assumed that his exposure had produced the lesion. I inquired further of him whether he was constipated. His answer was "You can guess that for yourself. When you are in a cab of an engine, you just learn to be constipated." But he did not have rectal cancer. How often would we elicit a positive history of a condition thought to be productive of a certain type of cancer in patients with other types of cancer, or with none at all, if we took the trouble to ask for it? We ask for what we want to find, and then reason that because we have found it, it is of significance.

We make the same type of mistake in collecting information on family history of cancer. One of the moot questions in connection with cancer is whether there is a genetic basis for cancer in general or for specific types of cancer. Again the forms referred to ask for "Family history of cancer." There are two possible answers, positive and negative. If positive, the inquirer probably asks what relatives had cancer, he may even go so far as to ask what relatives had what type of cancer, but that is putting a stretch upon the imagination. But if the answer is negative, it is left there, nothing is done about finding out why it is negative. It may be negative for one of several reasons. (1) It may be negative because no close relative who is dead was known to have had cancer when he died, and no close relative living has a known cancer. (2) It might be negative because the patient was uninformed. Since the policy of many of the profession is to conceal the fact that the patient has cancer, a positive history may be obscured by the patient's ignorance of the facts. Just recently, I had occasion to correspond with two sisters of the man with prostatic cancer just referred to. Both informed me that there was no cancer in their family, yet of the nine relatives whose names I could obtain in that family three had proved diagnoses of cancer. (3) The family history may be said to be negative because there was no family to show the disease. Thus the man may have prostatic cancer, yet all his brothers may have been sisters and all his uncles may have been aunts. If the possible genetic factor could be inherited through the female he might have received it from his mother who could not have prostatic cancer. He might have received it from his

father, who died at 35 before the age at which he would develop the cancer (4) The family history may be said to be negative, because the patient interviewed may be the first in the family to have developed it Had the history been reinvestigated 15 or 20 years later, several members of the family may have become affected When a man states that he has a negative family history for gastric cancer, but that he has 8 brothers and sisters living, all free, and had ten uncles and aunts on both sides of the family, all free, it may be a very different history from that of another man who gives the same history exactly In the first case, the man may have been the youngest of the family, and his mother and father were the youngest members of their respective families All his relatives lived to an age older than that at which he developed his gastric cancer The second man may have been the oldest of his family, and his father and mother the oldest of theirs, and all the aunts and uncles may have died before the age at which he showed his cancer, and his own brothers and sisters have not yet reached it Therefore, studies purporting to give an idea as to the role which heredity plays in cancer, and which state that 35 per cent let us say, of patients give a positive family history, while 65 per cent give a negative family history, or vice versa, are very likely to be worthless

Such studies, to be of any value, should state how many mothers of cancer and control patients of the same age, lived to be in age group 30 - 34, 35 - 39, etc., and how many mothers in each age group in the cancerous and non-cancerous divisions had cancer, how many fathers, uncles, aunts, first cousins, brothers and sisters, etc., lived to be in each age group and how many of them developed cancer and at what ages Thus the woman with breast or uterine cancer, with no female relatives except a mother who died young, or the man with prostatic cancer with no male relatives except a father, would have that family properly weighted in the study, and the statement that the family history was negative would be given no more importance than was due it When we consider that about 45 per cent of cancers in women and about 11.5 per cent of cancers in men are in the reproductive organs or breast and hence incapable of occurring or very unlikely to occur in the opposite sex, we can see how often a family history can be negative, because there was no relative of the appropriate sex and age to show the cancer This reminds me of a professor who said to me on one occasion after I had been lecturing on the influence of heredity in causing cancer, "My great-grandmother, my grandmother, and my own mother all had cancer of the uterus If what you say about heredity is true that is a very black outlook for me" I assured him that I could promise him immunity to that type of

cancer He was in the position of one being all dressed up and no place to go

Another factor which one is likely to forget in analysing cancer data for possible genetic factors, is that it is quite possible to find more cancer among relatives of non-cancerous persons than among the relatives of persons with cancer This is because the non-cancerous persons have as their cancerous relatives all of the persons with cancer, whereas the cancer patients have the cancer relatives minus themselves Let me illustrate Consider a litter of 11 mice from a strain which shows lung cancer Three of the 11 mice have cancer 8 are free Each mouse in the litter has 10 sibs, that is brothers and sisters Each non-cancer mouse has 10 sibs, 3 of which have cancer, an incidence of 30 per cent Each cancer mouse, on the other hand, has 10 sibs, only 2 of which have cancer, an incidence of 20 per cent Therefore, non-cancerous mice in this litter have $1\frac{1}{2}$ times as many cancer relatives as have the cancer mice Of course, that illustration was not exactly comparable to what we do when we collect data on human families, because we do not deliberately pick as our non-cancer control, a sibling of a cancer patient But cancer as a group of diseases is so common that we can scarcely pick a control case who did not have a relative with cancer Only when we study the genetic factors in a particular type of cancer, which is not so common that we are almost guaranteed to pick as a control a person from a cancer family, will we be able to use this method I wish to point out, however, that with a cancer that is very common, or if one is studying genetic factors of cancer in general, one can easily find that non-cancerous controls have a greater incidence of cancer among their relatives than have persons with cancer themselves

Another type of improper control for analysing cancer data arises through ignoring the fact that every cancer has a specific age incidence and sex predilection I have already mentioned breast uterine and prostatic cancers, but other types of cancer, not of the generative organs, have marked sex predilection Cancer of the lung is a good example It occurs four times as frequently in the male as in the female If we desire to make any study of causative factors in lung cancer we must be sure that our control group is comparable to our experimental group Again I will take an example from the literature A worker was investigating the possible role of silicosis in inducing lung cancer He compared the incidence of lung cancer in a group of 50 cases of silicosis, and in a large necropsy group of 4500 "unselected" cases from a general hospital He found that lung cancer was 7 times as frequent in the silicosis group as in the unselected necropsies This is an

excellent example of misunderstanding as to what is meant by "random" sample. Because the 4500 necropsies were "unselected" the worker thought that he had a good control group. As a matter of fact, in order to have a good control, he needed to select very carefully from these 4500 necropsies, those which he was to use as his standard. He forgot two things: (1) that lung cancer is 4 times as common in the male as in the female and that all his silicosis cases were males, therefore his unselected necropsies should have been highly selected to contain only males. Assuming that half of his 4500 necropsies were females, and that among them one fifth of the lung cancers occurred, one can easily show that had his control group been all males as was his silicosis group, lung cancer would have been only 4.8 times as common among the silicosis patients as among the general necropsy group instead of 7 times as he found it. (2) The second thing he forgot is that silicosis does not develop until 15 or 20 years of exposure have passed by. That placed all his silicosis patients in the late forties or early fifties, just when lung cancer becomes most common. Many of his general necropsy group were in the age range below 45, hence not in the lung cancer age. He should have selected only those males from the necropsy group who matched the age distribution of his silicosis patients. If he then found a significantly higher percentage of lung cancer among his silicosis patients he could have suggested a relationship between the two. Until that control group is properly studied, his results are valueless.

In the field of treatment we find many studies with figures not properly controlled. For example, Dr. A may state that with his treatment of cancer of the prostate, he has 50 per cent 5 year survivals, 10 per cent 10 year survivals, etc. Dr. B on the other hand with a second treatment has only 35 per cent 5 year survivals, and only 3 per cent 10 year survivals. (These figures are chosen for the sake of illustration and any resemblance between them and published data on prostatic cancer is purely coincidental.) We would be led to conclude that Dr. A's treatment was superior. What we should be told, however, in each instance is how many of their patients would have survived 5 or 10 years even had they had no prostatic cancer. If Dr. B's patients are for the most part nearing 80 years of age, while Dr. A's were in the neighborhood of 55 or 60, we understand that the first treatment may not have been better, Dr. A was merely more fortunate in picking them young.

In the treatment of lung cancer, one surgeon may have much better results than a second man has, but we need not conclude that the former is necessarily the better surgeon. He may merely have had better patients, with less disease in the other parts of

their body A group of patients who die of cerebral hemorrhage 6 months or a year after their lung has been removed for cancer, can spoil a good surgeon's survival rate Here again carefully controlled data are necessary before we can arrive at accurate conclusions

Nowhere, however, has there been more muddled thinking than on the question of whether lung cancer has increased or not The question has been impossible to answer because we have no standard of comparison We have no idea of how many lung cancers were undiagnosed 25 or 15 years ago, and no idea as to how many are undiagnosed today If 50 per cent were not recognized then and only 25 per cent were not recognized now, we could feel that lung cancer had increased by 50 per cent over what it had been in the past, whereas it had not increased at all, we merely recognized it when we saw it There is no doubt that it is being diagnosed more frequently, and that the apparent increase is even greater than can be accounted for by increase in age of the population

Various methods are resorted to in order to show that lung cancer has increased, even beyond the improvement in diagnosis and increase in age The percentage of lung cancers in hospital admissions is said to have increased But the opening of a new pediatrics wing or maternity ward can lower the percentage of cancers in hospital admissions, and the founding of a new surgical unit can increase it The percentage of lung cancers among necropsies has been thought to be a sounder method of proving the increase But that is no more valuable than the first method The zeal with which the physician presses for a necropsy is of prime importance in determining which cases come to necropsy, and the zeal of the physician is directly proportional to the lack of clarity in the diagnosis Hence the clear cut case of pneumonia, tuberculosis, or infection following trauma may not come to necropsy, but the obscure case, among which will be some lung cancer patients, will be necropsied A third method supposed to be superior to the other two, is the estimation of increase of lung cancer cases among the cancer necropsy cases Breast, uterine, rectal or prostatic cancer can be diagnosed by biopsy or at operation If the patient dies, the disease has already been proved pathologically, and there is no urge to have a necropsy The patient with vague symptoms perhaps with undifferentiated cancer in a lymph node, will come to necropsy, and may prove to be a lung cancer Thus since not all cancer cases were necropsied then or now such increase may be spurious Although as chest men you are no doubt seeing far more cases of lung cancer, there is not a single criterion by which we can prove that lung cancer is actually affecting more persons in the lung cancer age groups now than

it did 25 years ago You may merely be seeing more of it, because you recognize more of it, and not because there is more of it to recognize

Almost any conclusion which one wishes to draw about cancer can be supported by figures, if incorrectly collected or interpreted Without any elaborate statistical procedures of analysis, and with only a large amount of sense of what constitutes a good control, one can avoid many of the more obvious pitfalls which beset the person working with cancer data The two things to be remembered are, (1) that in order to have a good control group for study in comparing with a cancer group, the two groups should be as near alike in all respects save the cancer as it is possible to have them The second thing is that partial truths may be as misleading as falsehoods The best thing to do is to consult a competent statistician in the collection of your data, and in planning the analysis later The old saying that "Figures can't lie, although liars can figure" is not true Figures can lie, if by lying, we mean the creation of a false impression It is incumbent upon us, that we recognize a well controlled conclusion about cancer when we see it in print, so that we may not be misled into following false gods, and that we know how to arrive at a properly controlled conclusion that we may not place a stumbling block in the path of others who are following after us and trusting in the truth of our conclusions

SUMMARY

The prime requisite of data assembled to elucidate any problem is that it be collected without prejudice This requires that the same information be gathered from the group for which it is supposed that the data are pertinent, and from the control group If exposure to sunlight is regarded as a potential source of skin cancer, the presence of such exposure must be inquired into not only in skin cancer cases, but in patients not having skin cancer Failure to observe this rule will naturally produce biased data Forms in use by medical organizations for collecting information on possible causes of cancer of any specific organ ignore to a large extent this primary rule, asking for the presence of etiological agents where they are expected and failing to ask for the same agents in control groups, furnished by patients with cancers in organs other than the one supposed to be caused by the agent This procedure confirms preconceived ideas, and militates against advancing new ones

The second point to be noted is that the control group should correspond as nearly as possible in all respects with the group under investigation, with the single exception of the etiologic fac-

tor being investigated If silicosis is being considered as a causative agent in lung cancer, the control group should be as nearly like the experimental or observed group as possible in sex, age distribution, race, facilities for diagnosis, other possible carcinogenic factors, etc The only point in which the control group should differ in an ideal study would be that they were not exposed to free silica, whereas the experimental group was The incidence of lung cancer could then be compared in the two groups of patients This necessity is often ignored, and a "random" control group is obtained for comparison on the assumption that any group taken at random is a good group for comparison Fallacious results based on such studies are discussed briefly

RESUMEN

El principal requisito de datos coleccionados para dilucidar cualquier problema es que sean compilados sin prejuicio Esto requiere que se recojan los mismos informes del grupo al que se supone que tocan los datos, como del grupo de testigos Si se considera que la exposición al sol es una causa potencial del cáncer de la piel, se debe investigar la presencia de tal exposición no sólo en los casos de cáncer de la piel sino en pacientes que no sufren de cáncer de la piel La falta de observar esta regla naturalmente producirá datos parciales Los esqueletos usados por organizaciones médicas para copilar informes acerca de las posibles causas del cáncer de un órgano específico no hacen mucho caso de esta regla primordial, pues investigan la presencia de agentes etiológicos cuando se los espera, pero no preguntan por los mismos agentes en grupos de testigos proporcionados por pacientes con cánceres de órganos diferentes del que se supone ser causado por el agente en cuestión Este procedimiento sólo confirma ideas concebidas de antemano y se opone al desarrollo de nuevas ideas

El segundo punto que se debe notar es que el grupo de testigos corresponda lo más posible en todo respecto con el grupo bajo investigación, con la única excepción del factor etiológico que se está investigando Si se está estudiando la silicosis como un agente causal del cáncer del pulmón, el grupo de testigos debe ser lo más semejante al grupo experimental u observado en cuanto al sexo, edad raza, facilidades para el diagnóstico otros posibles factores carcinógenos, etc En un estudio ideal, el único punto en que el grupo de testigos debería diferir sería en que ellos no estuvieron expuestos a la sílice libre mientras que el grupo experimental sí lo estuvo Podría entonces compararse la frecuencia del cáncer del pulmón en los dos grupos de pacientes

Respiratory Volume Changes in the Pulmonary Blood Vessels in Relation to Artificial Relaxation Therapy*

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I *The Bridge*—the lesser circulation

It is helpful to think of the pulmonary vascular system as a one-way bridge for blood between the right and left hearts. The unique feature of this blood bridge is its motile environment. No other subdivision of the vascular system is surrounded, as are most of the parts of the pulmonary arterial and venous trees, by a web of passively expanding and actively contracting air-tissue which perpetually and usefully increases and decreases their capacity with each respiratory cycle. During inspiration this web, by pulling upon the walls of these blood vessels, to which it is directly attached, tends to lengthen and widen them, so enlarging their content and diminishing the resistance to the flowing blood within them, and hence lowering the pulmonary blood pressure, and all this it does by energy generated in the musculature of the chest wall and diaphragm, and transferred by alveolar air pressure. During expiration, on the other hand, through the relaxation of this enveloping tissue and the coincidental contraction of their own intrinsic elastic fibers, these vascular parts are shortened and narrowed, their content is diminished and the pulmonary blood pressure raised. The continued alternation of these lung-motivated processes of capacity increase and decrease, in which the pulmonary capillaries share passively, confers a pumping action upon the pulmonary vasculature which is most marked in the vigorously exercising young athlete. Viewed in this way the bridge of the normally functioning individual is propulsive, acting as an accessory heart. Let us examine first the evidence favoring inspiratory enlargement of these channels.

(A) *Inspiratory lengthening and widening*

That the pulmonary arteries and veins must elongate during inflation is clear from merely observing a fresh normal mammalian lung as it is being blown up, for its major dimensions as well as

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those of individual lobes increase. The vessels could no more remain unstretched in this process than could the bronchi (Macklin 1932a, 1932b, 1936). It is clear, too, that they cannot become narrow during this extension, as do rubber tubes when stretched, for there is no inspiratory impediment to the flowing blood such as would then certainly ensue. Yet we should not dismiss the matter as taken for granted like gravitation, for an analytical consideration gives us much insight into the way in which the bridge is made more capacious in inspiration. Fortunately when entering air is swelling the air-tubes, entering blood is synchronously swelling the blood-tubes. The act of breathing brings blood as well as air into the lungs.

Histology. Examination of microsections of the inflated lung shows that all but the hilar trunks and the finest tips of the branches of the pulmonary arteries and veins are so attached to their enveloping air spaces that the inflation of these must not only lengthen the vessels but widen them, or at least prevent their being narrowed. As an example of this intimacy of relation of vessel-wall and lung stroma, figure 1 is presented. It is a photomicrograph from a section cut from the inflated lung of a rabbit and shows small veins v , v_1 and v_2 to which are attached the surrounding air sacs, as . The walls of the blood vessels are enwrapped by the approximated bases of the alveoli to which they are firmly bound. It is clear that the row of air sacs enveloping v_1 , for instance, could not expand without increasing the length of v_1 .



FIGURE 1 Pulmonary venules in their investment of expansile lung tissue. From Plate II Macklin C. C., Trans. Roy. Soc. of Can., v. 39, Sect. 5, 3rd Ser. 1945. Rabbit A. S76-6R-2RM-9, 10 u. H and E X50. v , v_1 , v_2 = venules; as = alveolar sacs. The arterioles, arteries, and veins are similarly invested. The fine wrinkling of the walls is the result of technique.

Similarly in expanding they would not encroach upon the lumen of the venule, but rather would tend to draw away from it. This dilatational movement is not as easy to grasp as is the elongational one, but a study of v_1 and its setting of air sacs will help to make it plain. The expansion of this ring, or better, sleeve, aided by the blood pressure, would enlarge the vascular calibre. The same sort of radial pull on the part of the lung stroma is exerted upon the arteries as well as the veins (Macklin, 1945a). Some years ago it was shown to occur for the air tubes (Macklin, 1936). It is well to note that it is the normal lung which is being here considered, for in abnormal conditions there occur alterations in the mechanisms involved. The collective action of these motor sleeves of the blood vessels is shown in figure 2. In elongation the direction of shift of the long axis of the vessel is toward the narrower end.

Roentgenography of the living It has long been known that corresponding bronchovascular rays are considerably longer in the inspiratory than in the expiratory stage, as shown by their measurements in comparative roentgenograms, one of which was taken in full expiration and the other immediately thereafter in full inspiration, from the same healthy young subject in the same position. This is a convincing demonstration, as far as it goes, that there is inspiratory lengthening of the roentgenographically apprehensible parts of the arteries and veins, but this technic has not been well adapted to the display of inspiratory widening. More information has been gained for the bronchi by this method, particularly when their shadows are intensified by iodized oil. The

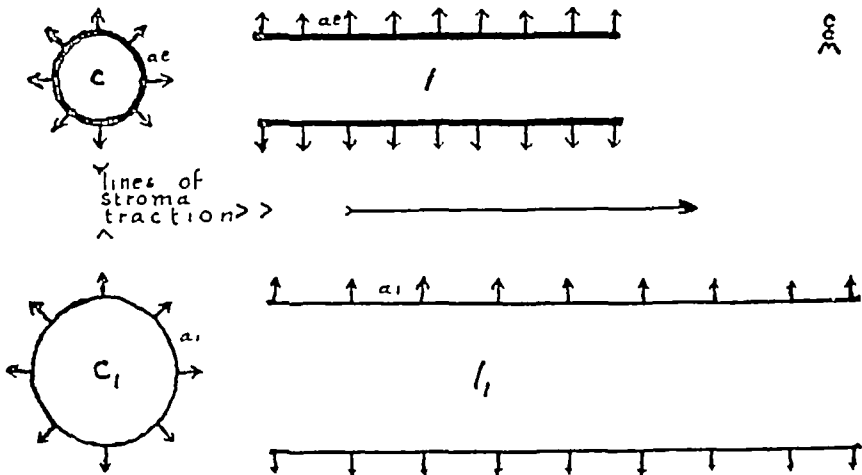


FIGURE 2—A diagram to show the expansile and extensile action on a pulmonary blood vessel of inflation of the surrounding alveoli. c and l show the same vessel in cross and longitudinal section in the phase of *expiration* and c_1 and l_1 give the same views of the same vessel in the phase of *inspiration*. ae is an alveolus in expiration, and a_1 is the same in inspiration. Only the bases and part of the side walls of the alveoli are seen.

technic described by Taylor in his paper at this meeting on "Clinical application of angiocardiology" would seem to hold out invitingly the promise of clearer visualization of the shadows of the pulmonary blood vessels in the contrasted phases of full expiration and full inspiration

Roentgenography of the dead More clear-cut evidence for elongational and dilatational movements of these vessels is obtained when the lumina are filled with a fluid radio-opaque mass* which will not run through the capillaries to cloud the picture under the conditions of the experiment. If in two equivalent animals the pulmonary artery of one is filled in collapse and of the other in moderate inflation, we see strikingly in the two radiograms that the vessels of the latter are not only considerably longer but also are generally wider than are those of the former, which speaks emphatically for the exertion of a radial traction upon the vessel walls by the lung stroma in the inflated condition (Macklin, 1945b). Even more dramatic is the result when a single fresh lung is used for the two contrasting phases (Macklin, 1946). Here the pulmonary arterial system is first filled with a radio-opaque fluid mass introduced from a reservoir *via* rubber tubing and a cannula tied into the stem of the artery just beyond the heart, whereupon an x-ray picture is immediately taken to show the arterial shadow in the collapsed lung. The lung is then inflated by mouth through a cannula in the trachea, at which the interesting reaction is beheld of the fluid in the reservoir *falling* as air is going into the lung, so indicating without doubt that the capacity of the pulmonary arterial system is being enlarged. New fluid is added to the reservoir during this time to keep the pressure constant. When as much fluid has entered the artery as it will take, with the pressure level approximating that in the collapsed lung, a second x-ray picture is taken. This shows that the various branches of the artery are longer, and usually wider, than in the collapsed state.

While these experiments do not duplicate the phases of expiration and inspiration, and the conditions are far from those of the living healthy animal, yet they and others of the same type serve to show that when the air in the sacs is increased even under moderate pressure there is created *more room* within the arteries and veins. It is found, however, that when the lung is over-inflated, that is blown up till the pleura is quite taut, it is possible,

*Synthetic latex, known as "neoprene" was obtained from American Anode, Inc. Akron, Ohio. It was made opaque by the addition of 10 to 20 per cent thorotrast (Heyden Chemical Corporation, New York). Another radio-opaque fluid mass was bismuth oxychloride (BIOC1) 5 per cent and gum acacia 10 per cent in water. These show the arterial or venous tree according to which trunk is injected, without capillary clouding, at pressures of about 18 inches.

by increasing the air-pressure, actually to force fluid *higher* in the reservoir X-ray pictures taken under such extreme air-pressure show the vessels much elongated but also narrowed This state of affairs, of course, is not that of normal breathing, but rather is analogous to artificial respiration in the closed chest by tracheal insufflation with overly high pressure

In other similar experiments the pulmonary vein system was injected in the same way in collapse and inflation, and x-rayed in these states, and the results were essentially like those of the artery In another case both arterial and venous systems were injected in the same lung, and x-rayed, with results of the same sort On re-collapsing such a lung with filled arterial or venous tree, and radiographing it, the shadow showed that the vessels had returned almost to the state of original collapse, most of the extra amount which had been taken up in inflation having been evacuated

Volumetrics The filling experiments mentioned suggested others (Macklin, 1946) Diluted latex* was used to fill two vertical calibrated reservoirs of glass tubing, one of which led into the pulmonary artery and the other into the pulmonary veins *via* the left atrium, of a dog heart-lung preparation** The two vascular trees of the collapsed lung were first filled by gravity and the levels of the latex in the two tubes photographically recorded The lung was then blown up by mouth through a tube in the trachea, during which process the latex fell fairly evenly in both tubes Upon release of the air from the lung the latex rose in the tubes Quantitative results were obtained Since the air-pressure used was above that of the atmosphere the demonstration of inflational vascular enlargement was even more striking than it would have been had the conditions been those of the living thorax, for with the higher pressure in the air sacs it might have been expected that the latex would have been forced out of the vessels, causing the level to rise in the tubes during the inflation, but the opposite result was obtained This experiment, which was repeated several times, gave a graphic illustration of the enlarging power of the expanding lung upon the capacity of the pulmonary arteries and veins To make the demonstration even more dramatic a motion picture was taken showing the

*The same latex (see footnote, p 537), diluted with 50 per cent distilled water, gave the best results It was felt that the capillary net was excluded When saline solution was used in the burettes it was felt that the capillary net was included (see Macklin, 1946)

**The pulmonary blood vessels were perfused with saline solution prior to being filled for roentgenograms or volumetric studies, and in many cases sodium nitrite was included to relax the muscle When the sodium nitrite was omitted a slenderer vascular shadow was cast in the x-rays

descent of the latex in the tubes while the lung was being blown up and its ascent during collapse. As before, if the pressure became too high during the inflation process, so that the pleura would no longer yield, the latex rose in the tubes, showing that it was possible to override the vascular enlarging mechanism by inhibiting the action of the stroma-pull.

But perhaps the most striking of all exhibitions of the enlarging effect of expanding lung tissue upon the arteries and veins was obtained when the lung was mounted on a platform which could be raised and lowered. After the arteries and veins had been filled with latex by gravity pressure the collapsed lung was raised until the cannulae leading into these vessels were on the same level as the latex in the tubes. Now when the lung was inflated the latex was actually drawn into the enlarged arteries and veins *against gravity*. The descent of the latex in the tubes was as much as 5 cm.

In this series of experiments the comparison was made of the fully collapsed with the inflated lung, but all the way along it was possible to compare vascular volumes of states of lesser inflation with those of greater, so obtaining data more nearly like those of the living, breathing lung, and always in passing from the lesser to the greater degree of inflation there was an enlargement of the capacity both in arteries and veins. It seems reasonable to conclude that in inspiration the pulmonary vascular volume is increased. In one case this increase was found to be about $33\frac{1}{3}$ per cent over the volume in the collapsed lung. A difficulty in these experiments was encountered from the rupturing of alveoli and leakage of air into the interstitial tissue, thus engendering pulmonic interstitial emphysema (Macklin, 1940, Macklin and Macklin, 1943, 1944). Masses of bubbles were often found at the end of the experiment under the pleura at the root of the lung. Another difficulty was the appearance of air emboli, particularly in the arteries, doubtless from invasion of the smaller blood vessels.

(B) *Expiratory shortening and narrowing*

The converse phase in the arteries and veins is a shortening and narrowing movement. By studying the histology of the part it is evident that the diminution in size of the sleeve of air sacs around any given length of the living artery or vein would be attended by a contraction of the enclosed vessel in length and width, and the behavior of the two great vascular trees is a replica, on an enlarged and complex scale, of what goes on in any fraction thereof. When the tension of the enveloping stroma lessens, the intrinsic elastic tissue of the vascular walls is able to recoil. Since so much of this elastic tissue is in the form of fibers running lengthwise in the walls, the shortening effect of

its recoil is material. Many elastic fibers, too, run in spirals and these, on shortening, narrow the vessels. Such movements go on even against the pressure of the blood within. It may be that the smooth muscle plays a part in this narrowing process (Macklin, 1945a) just as it has been thought to do in the bronchial tree in the respiratory cycle (Macklin, 1929). It may be noted that workers can agree upon little if anything definite for the pulmonary vasomotor mechanism to do (Cournand, 1947) and it may be that it is adjusted to the respiratory rhythm. Then too, the air pressure bearing down upon the vessels in expiration is greater than that of the atmosphere, and on this point something will be said later on. We have noted how, in the filling experiments, the lung could recoil so forcibly as to raise the level of the fluid in the reservoirs considerably, and much of this work is attributable to the contraction of the elastic fibers of the air sacs and bronchial tree, aiding those of the vessels.

(C) *The capillary net and its implication in respiratory movements*

In this rhythmic rise and fall of blood volume in the pulmonary vasculature the capillary net must share, and this it must do passively, motivated by environmental pressure fluctuations, for its loops protrude freely into the air spaces and its walls are not acted upon by the traction of the stroma in inspiration. With inspiratory lowering of environmental pressure the capillaries swell and with its expiratory elevation they shrink. Of similar order is the behavior of the precapillary arterioles and postcapillary venules. Looked at in "horizontal" view, the length of any given capillary is but an infinitesimal part of the total length of the pulmonary vascular bridge. The direct traction of the expansile tissue on the arteries and veins probably has the effect of protecting the capillaries from the bad effects of "negative pressure" by distributing the strain of expansion over the whole circuit rather than having it bear down unduly upon the capillaries as would be the case if the vascular system were "lung-free" (Macklin, 1945a).

D *Pulmonic blood-pumping movements in quiet breathing*

From what has been said it is concluded that the capacity of the entire pulmonary vascular bridge—arteries, capillaries and veins—is increased in inspiration and decreased in expiration, and that the constant repetition of this sequence has the effect of assisting the onward flow of the blood. It might be designated as a series of alternating systoles and diastoles. In expiration the vascular environmental pressure is greater than that of the atmosphere. There is then a pneumatic cushion pressing upon

the vessels The blood cannot go back into the right ventricle on account of the pulmonary semilunar valve, and must go on toward and into the left atrium This pump action, even at minimal level, would seem to function as a cardiac adjuvant The site of greatest degree of volume change is doubtless the massed peripheral parts of the arterial and venous trees where the channels are smaller, thinner-walled and more numerous This, then, would seem to be the most important part of the "pump" It is fortunate that the arteries and veins are so yielding, for if they were completely rigid we could have no breathing action of the lung at all Fortunately pulmonary arteriosclerosis (Macklin and Macklin, 1942) never becomes so extreme as to produce such a catastrophe

(E) *The augmented pump*

But the bridge is able to increase its capacity enormously in response to demand, and the contemplation of this protective and accommodational reaction in the young athlete in violent and prolonged physical exertion is very arresting Without an enormous enlargement of the traffic capacity of the bridge there would be a jam at the approaches, *i e*, right heart dilatation and systemic venous congestion The traffic is speeded up of course, but in addition the effective value of the thoroughfare is multiplied by the widening of the channels To get the greatest width the lungs must be held as fully expanded as possible, and this means that the chest tends to be operated at or near its maximal degree of expansion If we look at a young man coming in at the end of a gruelling race we find him with head up and chest high and full, with even the accessory muscles of inspiration taut and pulling open the thorax as much as possible In strenuous exercise the systemic circulation, of course, is vastly increased, and this means that the pulmonary circulation must be increased in like degree The two go together There can be no efficient augmentation of the systemic circulation without an equal augmentation of the pulmonary circulation So the pulmonic bridge must bear just as much increase of traffic as that experienced by the entire systemic circulation at this quickened tempo, for the two circuits are really one blood course It is fortunate that this pulmonary suspension bridge can have its traffic lanes pulled wider by innumerable guy-ropes held taut by the expanded air spaces Respiration under these circumstances is rapid and forcible, but it is at the upper level of chest capacity Of course it is commonly said that this extreme chest expansion is for the purpose of getting as much air as possible into the lungs and although no one would gainsay the essential truth of this statement, it is equally true that it is for the purpose of getting as much blood as possible

across the bridge in any given unit of time, not only for the purpose of picking up oxygen on the way but of keeping the movement of blood through the lungs equal to that through the rest of the body in order to avoid a "pile-up" at the bridge entrance. The chemical and nervous controls involved in this pump action are too complex to be discussed here. The general body circulation—the systemic bridge—controls the situation, carrying blood in great quantities and delivering much carbon dioxide into it to stimulate the respiratory center. It is interesting that the heart beats faster during inspiration than it does during expiration (sinus arrhythmia).

II *Implication of the Bridge in Operative Procedures*

(A) *A multipartite bridge*

We have been so much concerned with the physiological action of our bridge that we have not taken time to consider its anatomy, and when we do so we find that it is really two main bridges, one for each lung, and furthermore that each of these is subdivided into laneways for the lobes, which again are subdivided into smaller laneways for the lobules. Local alterations in the blood traffic follow certain medical and surgical operative procedures, producing hypoemia in some regions and hyperemia in others.

(B) *Compensatory hyperemia*

So far we have been concerned with the variable capacity of the entire bridge in the healthy person, particularly the young athlete. Now we enter the domain of pathology and look for a moment at the behavior of the parts of the bridge which remain after a section of it has been removed. Always the surviving portion of the bridge has to carry the *entire traffic*, not only its own share but the share of the part which has been removed, be it a lobe, two lobes, an entire lung, or even one lung and part of another. That is not to say that the task is done as well as before under all conditions, and it would seem that the functional reserve is cut down, but it is remarkable how well the bridge functions in its reduced dimensions. It makes up for the loss of traffic lanes by the widening of those that remain, and in this widening process compensatory emphysema (alveolar ectasia) and compensatory hyperemia go hand in hand. As always, the pull of the stroma, actuated by air pressure, widens the bridge (Macklin, 1945b), and enables it to carry the increased load. The enlargement of the arteries and veins so brought about probably prevents the development of "Factor B" and the supervention of pulmonary interstitial emphysema (Macklin and Macklin, 1944). I have been told (W. E. Adams¹⁴) that healthy dogs can survive with only some 15 per cent

of their lung substance remaining after operation, and that means that 15 per cent of the bridge is carrying 100 per cent of the blood traffic

This amazing ability of the bridge to compensate for the loss of parts of itself makes much of modern thoracic surgery possible. Who would dare to take out a lung or even a lobe if the remaining pulmonary blood streambed did not conveniently adapt itself to carrying without obstruction the share of the parts removed? Imagine what would happen to the patient if, after removal of a lung, the vessels of the other lung refused to carry the extra load! Fortunate indeed is it that the bridge has such great reserve capacity in its various parts, for this may be utilized by physicians, particularly chest physicians

(C) Relaxation therapy and accompanying hypoemia

But sections of the bridge may be altered in respect of their blood flow in ways other than by extirpation of part of the lung, and one of these is therapeutic collapse of more or less of the lung substance. By pneumothorax, phrenic paralysis or pneumoperitoneum the volume of an area of lung is reduced, as in the treatment of pulmonary tuberculosis. This has the effect of diminishing or abolishing the pull of the stroma upon the arteries and veins of the part. These vessels undergo shortening and narrowing, and the flow of blood in them is accordingly reduced. It is prudent for me to leave to the clinicians and pathologists the explanation of how relaxation therapy improves the local conditions and so benefits the patient. Certain it is that with relaxation comes rest, and rest for the diseased part often means opportunity for repair. We do not know as much about the metabolism of elastic tissue as we should, but it seems reasonable to assume that the constant extension and contraction of elastic fibers is attended by wear and tear which must be made good if the part is to continue to function well, and that the relief from these movements in a part harassed by disease would be beneficial. Condensation of the tissues means closing the ranks of the defending and repairing cells so giving them a better chance, and there remains enough blood supply to meet their needs. Danger of hemorrhage is reduced and elimination of exudate favored. Then, too, it has been pointed out (Banyai 1946) that the bacillus tuberculosis being an aerobe is put at a disadvantage in a therapeutically relaxed part of the lung because of local diminution of available oxygen resulting from hypoemia (hypemia, hypoemia). So all things work together for the good of the patient and the discomfiture of the invaders. With the reduction of the pulmonary blood flow in the relaxed part there is associated an augmentation

of the flow in other healthier parts, enabling them to assume larger duties. The nutritional (bronchial) blood supply is conserved in the relaxed part, and the healing of local tuberculous lesions favored. The paper of Barach *et al* at this meeting on "Disappearance of cavity in the lung immobilizing chambers in nine patients with pulmonary tuberculosis" describes what appears to be a generalized relative collapse, or universal hypoinflation, of the unmoving lungs. In such a situation the pulmonary arteries and veins would not be subjected to inspiratory stroma pull, and the pump action would be abolished. This state in these vessels would seem to be the antithesis of that in the lungs of the strenuously exercising athlete, where they are fully opened up and showing the pump action in a marked degree.

III *Deterioration of the Bridge*

The pulmonary vascular bridge can deteriorate as a result of age or disease, and malfunction ensue. This change can be intrinsic, as seen in arterio-sclerosis, which would not only interfere with functional elongation and widening, but also with the contractile mechanism of the vessel walls. So the pumping movement would be curtailed. Consideration of the various aspects of extrinsic deterioration would take us too far afield for the purposes of this paper. It is an intriguing subject. The age changes alone (Macklin and Macklin, 1942) are very important. Bronchosclerosis, medical emphysema, fibrosis from many causes and pulmonary tuberculosis are among some of the many conditions which hamper the function of the bridge. Lobar pneumonia offers an alluring opportunity for the study of the impaired bridge, for the arteries and veins, on account of the expansion of the air-spaces with exudate, are elongated and possibly widened, but there could be no pump action, and the lack of this may help to explain the impaired circulation in the affected part. Even at that, the diseased lobe would act as a robber of pulmonic blood, contributing nothing of value and taxing the right heart while adding toxins to the body. Since the part tends to retain its volume to a great extent if not completely, the advantages of compensatory emphysema and hyperemia in more normal parts are difficult of attainment. Different is the situation in massive collapse, and to a lesser degree in any atelectatic area, for here, with the slackening of stroma traction and the ensuing local hypoemia, there can occur a compensatory hyperemia in other parts where compensatory emphysema increases the stroma pull and so enlarges the capacity of the bridge. There is a limit to the amount of space reduction which can occur in the unaltered thorax and when one region of lung becomes shrunken there is a tendency for other parts to swell with air to

fill the space, and we see this tendency exemplified in massive collapse with its blood shunt to other parts of the lung which have become hyperexpanded. Much more could be said under this heading, as in the consideration of bridge deterioration in the various heart derangements, and in a host of constitutional disorders, or in the strictly local accident of embolism or thrombosis with supervening infarction. Master's paper at this meeting on "Pulmonary embolism as a cause of acute coronary insufficiency" indicates that sudden interruption of pulmonary bridge traffic leads to diminution of systemic bridge traffic, with consequent aortic and coronary insufficiency, causing myocardial anoxia and ischemia. Anemia of the coronary system indeed would be apt to follow interruption of pulmonary bridge traffic of gradual, as well as sudden, onset. Pulmonic interstitial emphysema, by pressing on the arterial and venous walls, impedes bridge traffic. Withdrawal of air has given relief (Macklin and Macklin, 1944).

IV *Assistance to the Bridge*

Fortunately in health the bridge operates automatically. Its chemical and neuronal controls carry on so smoothly that there is no need to worry. Automaticity rules. We have noted how it can overcome seemingly impossible difficulties and handle prodigious masses of blood as in the Marathon runner. Yet even in the case of Pheidippides it seems likely that there was a fatal traffic jam because he did not give heed to the care of his bridge but felt obliged to make a speech instead of to keep his pulmonary traffic lanes wide open and the "Brustorgan" working. We of older years and poorer physical condition should take good care of our pulmonary bridges. If we have to run for a car or climb a long stair or shovel snow or carry out heavy loads of ashes from the furnace we should, if out of breath, stop and fill our lungs full, breathing hard at the top level of chest capacity, in short we should imitate the athlete. We should advise our patients to do this. Thus we may prevent right heart over-dilatation and coronary anemia, may avoid tragedy. Better still, if need be, we should lie down on the back, with our knees pulled up to give the diaphragm free scope and in that position, with the blood stream horizontal, relieve the congestion at the bridge approaches by hard breathing with the thorax full. So will we save our hearts—our lives. Physician, look to your bridge!

SUMMARY

The lung tissue has a synergic action on the pulmonary arteries and veins which are interwoven in it, and particularly on those of smaller size whereby their volume is increased in inflation

and decreased in deflation. This rhythmic volume change forms what has been called a "lung pulse," which is experienced passively by the capillary bed, and is most marked in vigorous exercise. Thus the lung, motivated by the musculature of the chest walls and diaphragm, has the effect of an accessory heart. This lung pump, when needed, should be kept working at full capacity. Sudden reduction of its action, as in runners or oarsmen, after a gruelling race, would have serious, even disastrous consequences. When resting in the ascent of a long stair or after other marked exertion one should breathe forcibly with the lungs well filled, for in this way blood is best moved across the "thoracic bridge" and congestion of the right heart and coronary anemia prevented. Dilatational action is by a direct pull of the lung stroma upon the arterial and venous walls during inspiration, which tends to increase the length and width of these vessels. The peripheral resistance in the pulmonary circulation is thus lowered by enlargement of the streambed due to outside assistance, and the right heart is aided. In the vascular volume decrease of expiration there is, following release of the stroma tension, a recoil of the elastic fibers of the vessel walls, leading to shortening and narrowing of the vessels. Histological, roentgenological and volumetric evidence is advanced in support of these conclusions. Advanced age, alveolar emphysema and other conditions decrease the efficiency of this lung pump.

Artificial relaxation of the lung, by abolishing stroma pull on the arteries and veins, diminishes the effective caliber of the pulmonary vasculature, so reducing the physiological blood flow while maintaining the nutritional flow in the bronchial vessels. There would probably develop in the collapsed lung region a relative tissue anoxemia and carbon dioxide increase, thus providing conditions inimical to the growth of the tubercle bacillus, while maintaining sufficient vitality in the tissues to insure regeneration and healing.

RESUMEN

El tejido pulmonar ejerce una acción sinérgica sobre las arterias y venas pulmonares que están entrelazadas en él, y particularmente sobre las de pequeño tamaño, por medio del cual sus volúmenes aumentan durante la inflación y disminuyen durante la desinflación. Esta alteración rítmica del volumen forma lo que se ha llamado un "pulso pulmonar," que lo sufre pasivamente la red capilar y que es más marcado durante el ejercicio vigoroso. De manera que el pulmón, motivado por la musculatura de las paredes del tórax y el diafragma, hace el efecto de un corazón accesorio. Esta bomba pulmonar, cuando se la necesita, debe man-

tenerse funcionando en su capacidad total. La reducción repentina de su acción, como en corredores o en remeros, después de una carrera agotadora, tendría consecuencias graves y aun desastrosas. Cuando se descansa, durante la subida de una escalera larga o después de otro esfuerzo marcado, debe uno respirar forzosamente y llenarse bien los pulmones, porque de esta manera se mueve mejor la sangre a través del "puente torácico" y se evita la congestión del corazón derecho y la anemia coronaria. La acción dilatadora se debe a que el estroma pulmonar ejerce un tirón directo sobre las paredes de las arterias y venas durante la inspiración, lo que tiende a aumentar la longitud y anchura de esos vasos. La resistencia periférica en la circulación pulmonar queda disminuida debido al ensanchamiento de la red vascular causada por la ayuda externa, y esto asiste al corazón derecho. Cuando disminuye la tensión del estroma durante la fase expiratoria, decrece el volumen vascular debido al retroceso de las fibras elásticas de las paredes de los vasos, lo que causa que se acorten y angosten estos vasos. Se presentan datos histológicos, roentgenológicos y volumétricos para apoyar estas conclusiones. La edad avanzada, el enfisema alveolar y otras condiciones disminuyen la eficiencia de esta bomba pulmonar.

La dilatación artificial del pulmón destruye la acción del estroma sobre las arterias y venas y disminuye así el calibre efectivo de la red vascular del pulmón, reduciendo de esta manera la circulación fisiológica pero manteniendo la circulación nutritiva en los vasos bronquiales. En la región colapsada del pulmón probablemente se desarrolla una relativa anoxemia y aumento del anhídrido carbónico de los tejidos, lo que produce condiciones perjudiciales al crecimiento del bacilo tuberculoso, pero mantiene suficiente vitalidad en los tejidos para asegurar la regeneración y cicatrización.

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D i s c u s s i o n

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Professor Macklin has presented clear cut evidence of a fundamental concept That the physiological factors that play a part in producing bronchial changes are applicable to the pulmonary vessels is a concept not difficult to accept

To date, there have been no studies of this type made on humans Fortunately I found a patient with emphysema, asthma, and dilated pulmonary vessels Inspiration and expiration films were made and changes of the right hilum were measured A gross change in maximum length and width of the right hilum was easily demonstrated There was a thirteen per cent increase in area on inspiration

The areas of two pulmonary arteries increased on inspiration, a large one increased fourteen per cent, and a smaller one increased twenty-four per cent

These findings agree with Dr Macklin's The application of a suitable technique in kymography and angiography would be of great interest in this work

D I S C U S S I O N

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The pulmonary circulation and its possible relationship to the pathogenesis of certain diseases is a subject which is not well understood. When it is, such questions as the mysterious preponderance of pulmonary tuberculosis in the apices, the greater frequency of hydrothorax on the right side, more common occurrence of antemortem thrombosis of the pulmonary artery, the greater incidence of lower lobe tuberculosis on the right side and other equally curious conditions may become clear. Doctor Macklin has demonstrated that the pulmonary tissue has a pulling action on the vessels, and particularly on those of smaller size, whereby their volume is increased in inflation and decreased in deflation. This change of the volume which he has designated a "lung pulse" is most pronounced in vigorous exercise. The dilatational action is by a direct pull of the pulmonary parenchyma upon the walls of the vessels. The collapse therapy by abolishing the pull on the vessels, diminished the caliber of the vessels, so reducing the volume of blood flow.

The postmortem arteriograms of the collapsed lungs demonstrated the shortening and narrowing of the lumens of the vessels. The quantitative measurements of the latex flowing through the models constructed after these arteriograms suggested that the minute volume of the blood through the vessels in the collapsed lung may be smaller than that in the normal lung at any one time, but the speed of the flow seems faster. Therefore, after a certain length of time the total volume of blood flowing through the collapsed lung may be even greater than that through the non-collapsed lung.

The speed of blood flow seems faster in the left lung as shown by the determination of the velocity of the pleura to the tongue circulation time which will appear in "Diseases of the Chest." The reason for this may be due to the greater massaging effect of the cardiac impact upon the left lung. The reason for the lesser frequency of hydrothorax on the left side may be due to faster blood flow through this lung by the reason of greater pulmonary passive movements.

Mr. Chairman: We hope that there will be more investigations on the physiology of the pulmonary circulation, a part of which was so clearly demonstrated by Doctor Macklin.

Silicosis as Viewed by an Internist*

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The presence of silicosis in man dates back to early times. According to Hale¹ it may be the earliest of all occupational diseases. This condition was first described by Hippocrates who noted it in certain metal grinders, but it has only been during the last 25 years that our knowledge of silicosis has been materially increased.

Not all persons exposed to silica dust develop silicosis. The following conditions influence the production of this disease: (1) Size of the silica particles (2) Number of particles per cubic foot of air present at the breathing level (3) Free or combined state of silica (4) Duration of inhalation (5) Humidity of working atmosphere (6) Condition of the ciliated epithelium of the individual.

According to the Department of Labor² and U S Public Health Service³ investigations, particles larger than 10 microns in size are not capable of producing pulmonary fibrosis, and are not found beyond this size on microscopic examinations of the lung. The greatest harm is produced by those between 1 and 3 microns.

The National Silicosis Conference holds that exposure to a concentration up to 5 million particles per cubic foot of dust composed of 70 to 80 per cent silica is without danger, but over this concentration there is the possibility of developing silicosis.

In areas such as Colorado where the silica particles in the dust average about 35 per cent, 10 million particles per cubic foot may be present without development of silicosis, when one is exposed for ten years, however, when the concentration reaches 20 million particles, silicosis may appear after ten years of exposure. The higher the concentration the more rapid the disease is liable to develop.

Cummings⁴ states that moisture is helpful in the prevention of dust and has reduced the incidence of silicosis among workers, but others have reported an increasing incidence of tuberculous infection among workers in mines with high humidity. He feels that adequate ventilation and humidity within normal limits is preferable.

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The ciliated epithelium of the trachea and bronchi prevents many of the fine particles of silica from entering the lungs. The condition of the ciliated epithelium probably accounts for the varied degrees of development of silicosis in individuals working under the same conditions. Previous infection, causing destruction or decreased motility of the cilia in certain individuals, greatly alters the ability of the system to remove the particles of inhaled dust. The work of Barclay,⁵ et al, on ciliary movement is convincing.

Chronic irritation of the air passages results in replacement of ciliated epithelium by goblet cells and increased production of mucus by the buried glands. The absence of ciliated epithelium which normally removes dust and the excess mucus facilitate the downward movement of foreign material.

When dust passes the protective cilia and reaches the pulmonary alveoli, the phagocytes emerge from the capillary walls and ingest the particles. When the phagocyte becomes laden with silica particles it enters the adjacent lymph spaces and passes toward the lung hilum. A trail of collagen forms after some of these phagocytes pass which is thought to be produced by the stimulated but normal adjacent tissues. Early in the exposure to silica some of the phagocytes pursue a simple course into the blood stream. Later fibrous tissue prevents easy passage of the phagocytes and their load of irritating silica is deposited, resulting in more fibrosis. In time, the nodules attain such size as to cast x-ray shadows. As these nodules become larger they coalesce, and offer more obstruction to the x-ray.⁶ The development of demonstrable silicosis may require from 1½ to 30 years.

Symptoms and Physical Signs

Symptoms and physical signs may be lacking even in an advanced case of silicosis, therefore careful history taking is of the greatest importance in the detection of this disease. When present, the most characteristic symptom is dyspnea. At first there may be little or no cough, but in the later stages cough and expectoration usually are present, particularly in the morning. As the case advances there is a gradual failing in health and strength and vague gastrointestinal disturbances appear. In uncomplicated cases there is usually no fever unless a tuberculous process or other infection develops.

Physical signs in the chest are usually those found in a bronchitis, along with signs of emphysema, however many cases have no physical signs whatsoever. The roentgenogram is an essential medium in the diagnosis of silicosis.

Classification

Many excellent classifications have been given for this disease by such authorities as Pancoast,⁷ Pendergrass,⁸ Gardner⁹ and Sampson¹⁰ For this discussion the following classification of Garland¹¹ is followed

1) Incipient Type Hilar shadows wider and denser than normal, perihilar pulmonary tree markings wider than normal

2) Interstitial Type Hilar shadows wider and denser than normal, slight or moderate diffuse thickening of the pulmonary tree markings, associated with faint haze in the middle or lower thirds of the lungs in early cases, extensive thickening in well established cases Limitation of diaphragmatic excursion (varying from slight to marked)

3) Nodular Type Hilar shadows wider and denser than normal, diffuse scattering of small, dense, discrete nodules throughout both lungs, especially in the middle thirds, apices and costophrenic angles usually free, limitation of diaphragmatic excursion

4) Advanced (or Conglomerate Type) Hilar shadows less prominent than usual, diffuse thickening of pulmonary tree markings, and/or diffuse nodulations, small or large areas of density due to coalescence of fibrotic or nodular lesions, emphysema, limitation of diaphragmatic excursion, occasional cavitation, enlargement of the right side of the heart

Conditions Simulating Silicosis

There are certain diseases which simulate silicosis when studied by x-ray, however, careful interpretation of the x-ray films combined with clinical information should rule out most of these conditions In the incipient type of silicosis, passive congestion of the lung may be confusing In the interstitial type, passive congestion of the lungs (cardiac), acute and chronic respiratory infections, polycythemia, metastatic malignancies, certain lymphoblastoma (infiltrative Hodgkin's disease) often confuse the picture Miliary tuberculosis (Fig 1A), metastatic malignancies, peri-arteritis nodosa (Fig 1B), mycoses (Fig 1C), and pulmonary arterial sclerosis (Fig 1D), may often be confused with the nodular type

Passive congestion of the lungs can be confused with silicosis if the individual is a worker in silica dust, as the following case illustrates

Case 2, G R This man came to our office February 3, 1943 complaining of extreme shortness of breath on exertion and had been coughing for several days He was short of breath upon lying down He gave a history of working in a quartz mine Upon examination wheezing was heard throughout his chest, his temperature was 101 degrees and there was clubbing of the fingers He was sent to Colorado General Hospital with a

diagnosis of bronchial pneumonia and cardiac failure, superimposed on silicosis. X-ray inspection revealed evidence of broncho-pneumonia and possible silicotic changes in both lungs (Fig 2b)

The patient was placed on routine pneumonia and cardiac treatment but rapidly failed and died on February 9, 1943. Autopsy revealed confluent bilateral bronchopneumonia, fibro-purulent pericarditis, dilatation and hypertrophy of the heart, subacute thrombosis of the descending

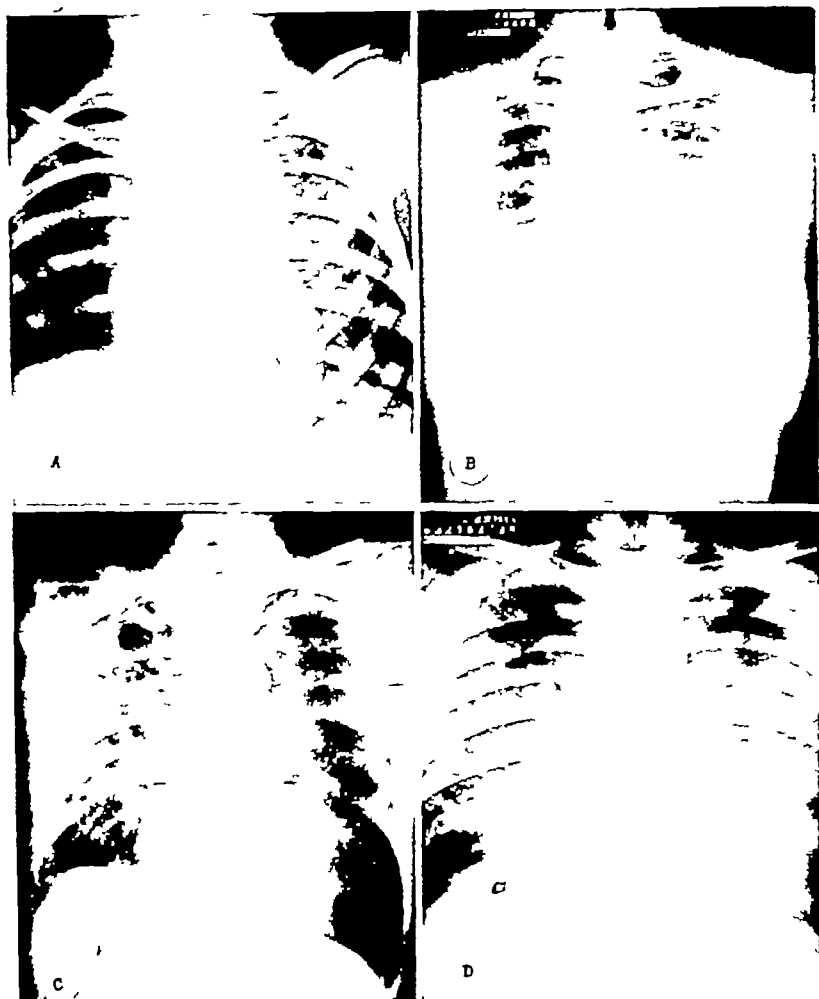


FIGURE 1 Cases showing conditions simulating silicosis

(A) Miliary tuberculosis. The tracheal bronchial rather than the hilum lymph nodes are enlarged. Bases not so clear and nodules more minute than in silicosis.—(B) Peri-arteritis nodosa. The bases are not so clear and the nodulation not as dense as in silicosis.—(C) Fungus infection—Blastomycosis. Less hilar involvement than in silicosis and asymmetrical involvement of the lung.—(D) Pulmonary arterial sclerosis. The trunk shadows are less prominent and the nodulation is finer and more granular. The bases are not so clear as in silicosis.

branch of the left coronary artery, fatty metamorphosis of the liver, cloudy swelling of the kidneys, moderate hydrothorax and ascites, but there was no evidence of silicosis

We were able to obtain x-ray films taken June 13, 1942 which revealed little or no evidence of silicosis (Fig 2a) The history of quartz mining mislead us in making a diagnosis of underlying silicosis It later was learned that he worked for only 7 months for a mining company as a helper and oiler in the mill

Symptoms due to polycythemia can be misleading, especially when this condition exists with mild silicosis

Case 3, J B This patient was first examined on March 24, 1938 He had fallen fifty feet in a mine shaft November 16, 1937 and was seriously injured Our examination was made to determine whether his symptoms were due to this accident He complained of weakness, constant headache, sleepiness during the day, shortness of breath, persistent cough and duskeness about the face which was more pronounced when he worked in the mountains This condition had existed since 1928

Examination revealed a well developed man with a cyanosis of the face and neck and slight exophthalmos The eyes were congested There was increased bronchial breathing throughout the chest The liver was slightly enlarged The hands and feet were cyanotic with clubbing of the fingers Blood pressure was 130/80 The hemoglobin was 120 per cent and there were 8,220,000 red cells The basal metabolic rate was +30 per cent An electrocardiogram showed right preponderance and occasional right ventricular premature contraction

On March 29, 1938 the x-ray report was as follows " early, second stage pneumoconiosis The evidence of this is intensification of both hilum shadows and exaggeration of the lymphoid elements of both lungs The bases of both lungs appear to be a little more clear than the remaining portion of the lung field" (Fig 3a) "A study in the lateral oblique and postero-anterior view by stereoscopic examination does not disclose

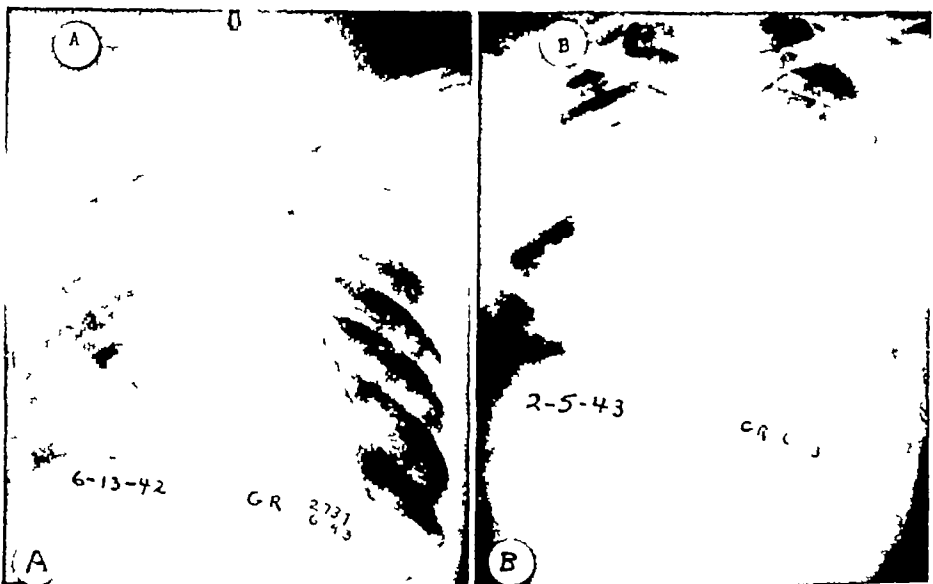


FIGURE 2, CASE 2 Passive congestion of the lungs simulating silicosis

the roentgen signs of enlarged right or left pulmonary artery. A very slight enlargement cannot be excluded by x-ray examination" (Fig 3b).

He was told he had polycythemia with possible Ayerza's disease superimposed upon silicosis. We obtained x-ray films and data taken on August 24, 1938 (Fig 3c) and November 29, 1943 (Fig 3d). The later film was similar to those taken in 1938 except that there was a marked increase in opacity to both hilum lymph node areas. This is an occasional finding in silicosis upon which we will later elaborate. He had not worked in silica dust for 6 years. His hemoglobin was 112 per cent, red blood cell count 6,200,000. The electrocardiogram showed no right preponderance. This is probably due to the fact that the left ventricle is now slightly enlarged as well as the right.

This case illustrates that polycythemia and cardiac failure was the greatest disabling factor, even though silicosis was present.

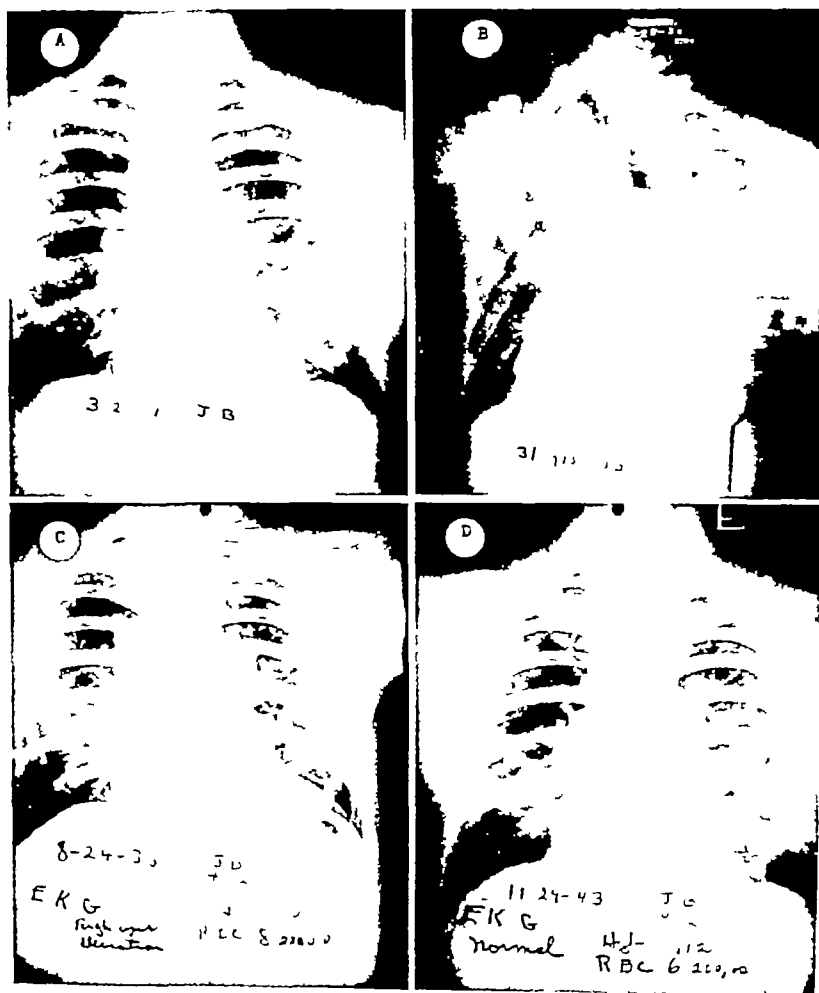


FIGURE 3 CASE 3 Polycythemia with silicosis

Lung Tumors

Tumors of the lungs are often confused with silicosis, however, under certain conditions, the latter may be wrongly diagnosed as lung tumor, which is illustrated by the following case

Case 4, FM This man was injured May 23, 1932 by having an iron tripod fall against his chest and right shoulder. He was disabled for only six days and then returned to work in the quartz mine. On January 1, 1935 he stopped work because of shortness of breath, severe cough and weight loss which he thought were due to his 1932 accident. Our examination on June 18, 1935 revealed a rather sick appearing man, edentulous, with enlarged and infected tonsils. There was a small area of hyperresonance with slight decrease in breath sounds in the apex of the right lung. Below this there was a slight dullness. Inspiration sounds were rough and prolonged over the entire chest. The liver was slightly enlarged and a right inguinal hernia was present.

The x-ray report was as follows: "X-ray examination of the lung fields disclose confluent pneumoconiosis in both lungs. The right upper lobe region shows a more discrete density than other parts of the lung fields. This has been reported as a lung tumor elsewhere. A diagnosis of silicosis was made" (Fig 4b). An x-ray film, taken elsewhere in April, 1935 showed somewhat the same condition except that in the right apex there was pneumothorax with a rather definite outline of the lung below (Fig 4a). Otherwise the film was similar to that taken in June, 1935.

A diagnosis of lung tumor had been made elsewhere. The reason for this confusion possibly lies in the fact that a pneumothorax was present and compressed the silicotic lung giving it the appearance of a tumor. Autopsy in the spring of 1937 revealed no evidence of tumor but silicosis was present.

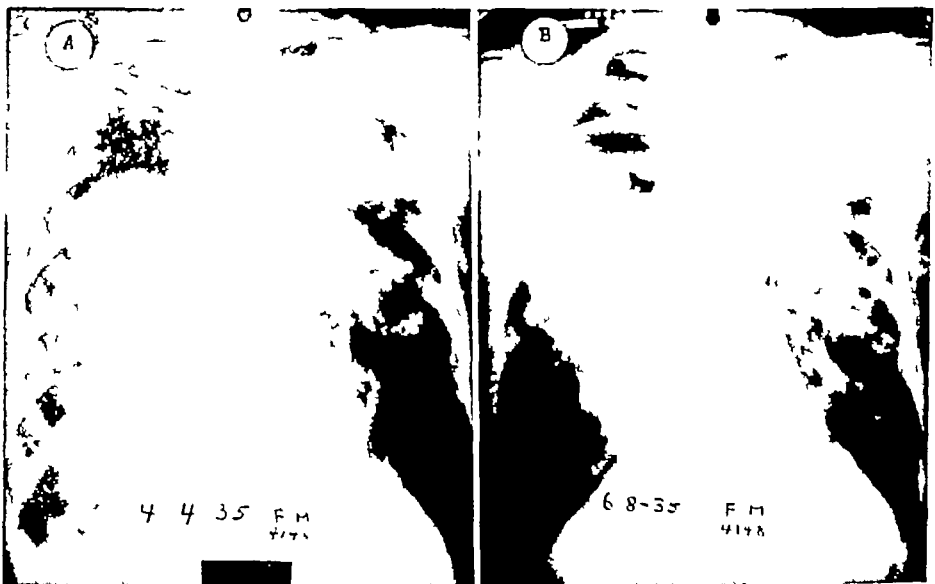


FIGURE 4, CASE 4 Silicosis simulating lung tumor

Progress of Silicosis

The author has been interested for some time as to why some men working under similar conditions, develop the disease rapidly, and others show no definite progression

Bamberger¹² has shown that among men working under the same conditions in mining operations at the same time, one develops only mild linear exaggerations while another presents far advanced nodular silicosis

This condition probably is due to the inability of the cilia to protect against the dust invasion. The following cases illustrate the development of silicosis in men working under similar conditions at about the same time

Case 5, C.G.P. This man was born March 29, 1909 in Missouri and worked as a farmer until 1935 when he was employed for three months as a machine man in tunnel construction. Then for one year he worked in dam construction. In 1937 he began work as a quartz miner. On November 6, 1940 the first x-ray revealed slight changes (Fig 5a) and by December 30, 1942 a definite nodular type of silicosis had developed (Fig 5b). On January 21, 1943 he complained of dyspnea, pain over the heart, dizzy spells, persistent cough and rapid heart on exertion. There was a loss of appetite and weight. An electrocardiogram was normal except for right axis deviation.

Case 6 C.S. This man was born on November 26, 1905 in Leadville, Colorado. From 1936 to 1942 he was employed as a quartz miner. The first x-ray inspection made on December 10, 1940 suggested the presence of silicosis (Fig 6a). During 1941 he suffered a series of upper respiratory infections. By April 1, 1942 there were prominent linear markings with

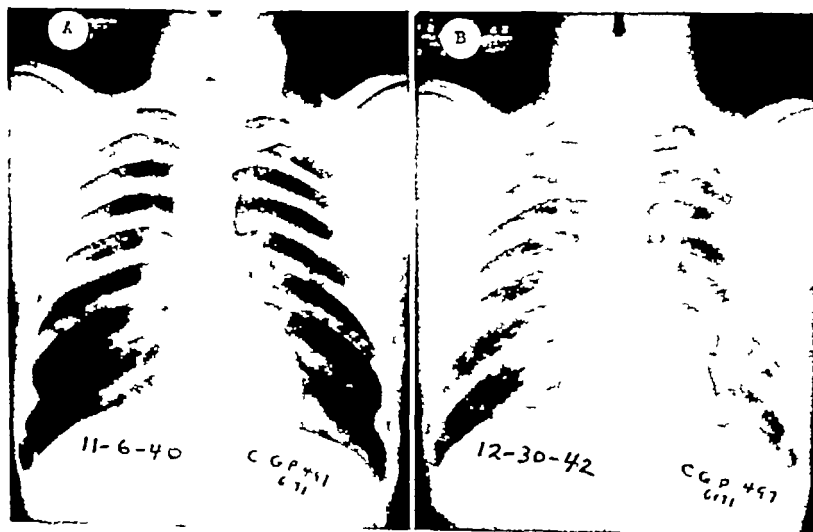


FIGURE 5 CASE 5 Progress of silicosis

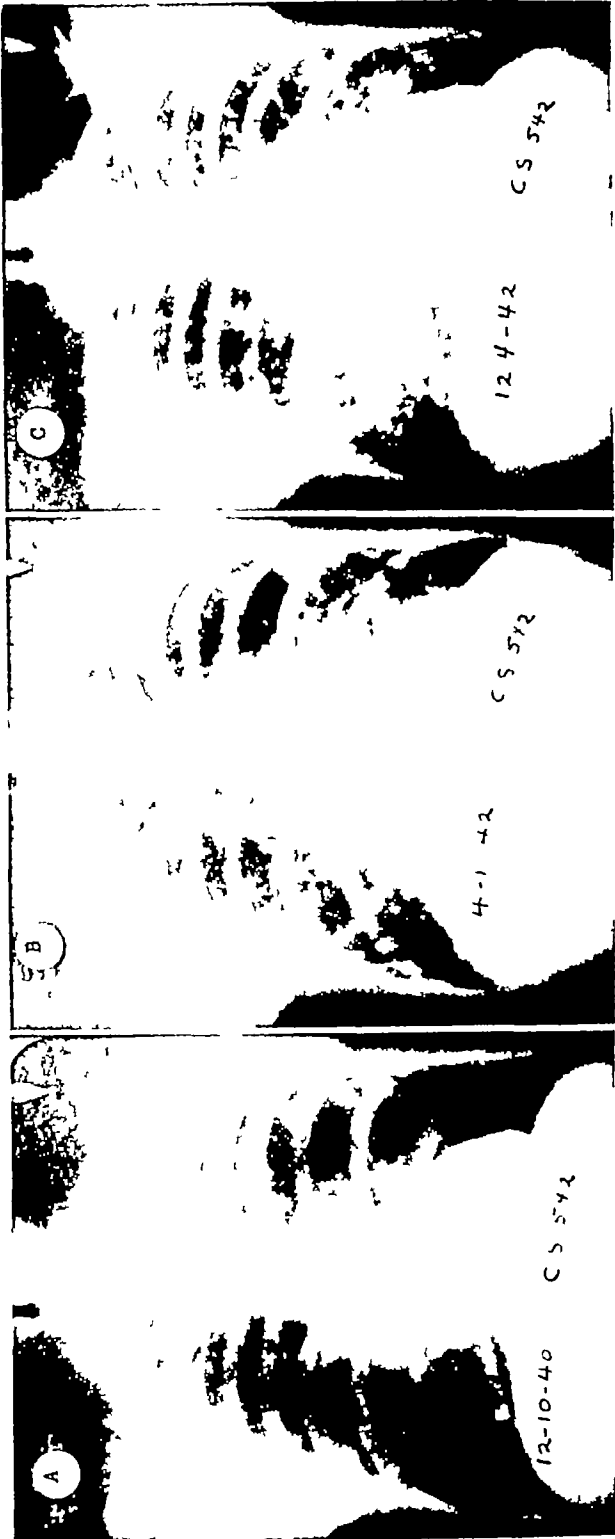


FIGURE 6, CASE 6 Progress of silicosis

some areas of nodulation and increased hilar shadows (Fig 6b) He was removed from the quartz dust and worked above ground By December 4 1942 there was evidence of advanced nodular silicosis, of the conglomerate form (Fig 6c)

The above cases were working in the same mine under practically the same conditions including the time element, and it can be readily noted that they show different stages of silicosis Other men working with them under the same conditions showed little or no evidence of silicosis These cases afford evidence that infection and other conditions already discussed are factors in the variability of the development of silicosis

Development of Silicosis After Removal from Dust

Usually the removal of the worker from exposure to silica dust checks further development of silicosis There are some cases, who even though removed from inhalation of silica dust, continue to show signs of increased nodulation and fibrosis Infection plays an important role as suggested by the following cases

Case 7 J.D.W. This man of 50 years was examined December 23, 1937 He had been a quartz miner since 14 years of age In the previous eight weeks he had cough and raised sputum, lost 30 pounds and complained of dyspnea There was increased bronchial breathing all over the chest, with some coarse rales to the right of the sternum X-ray inspection on December 23, 1937 showed exaggeration of the linear markings and thickening of the pleura in the right upper interlobar fissure (Fig 7a) X-ray inspection on February 2 1938 showed increase of the linear markings since December The lower portion of the right lung revealed definite inflammatory changes which apparently represented superimposed infection and increase of silicosis (Fig 7b) This man had not worked in the mines for five months and yet there was evidence of advancement of the silicosis

Case 7b illustrates advancement of silicosis even though work in a quartz mine had been discontinued for 4 years Dr Berry kindly furnished the following data This man of 36 years was a quartz miner for ten years On May 5 1943 there was evidence of slight nodulation and enlargement of the hilar shadows (Fig 7c) The electrocardiogram showed evidence of pathological changes He then was in the army until 1946 During this interval there was no history of exposure to silica dust He was asymptomatic but on April 18 1946 discrete nodulation was seen throughout both lungs (Fig 7d)

In addition to the above cases some of our previously quoted cases showed the same phenomena (Case 3, Fig 3 and Case 6, Fig 6)

Cardiac and Tuberculous Complications

When silicosis reaches the advanced or massive conglomerate form most cases begin to complain of shortness of breath, especially in high altitudes due to decreased respiratory reserve Occas-

ionally cases of far advanced silicosis suffer little dyspnea but as a rule a compensatory polycythemia is found. In those cases that develop a cardiac condition right heart failure is the most common. Often before cardiac decompensation occurs the only sign present is an accentuated pulmonary second sound. In some of our cases right ventricular enlargement by x-ray and right axis deviation could be demonstrated before cardiac decompensation occurred. An occasional case has been found to have left ventricular hypertrophy but usually at autopsy, bilateral ventricular hypertrophy is present.

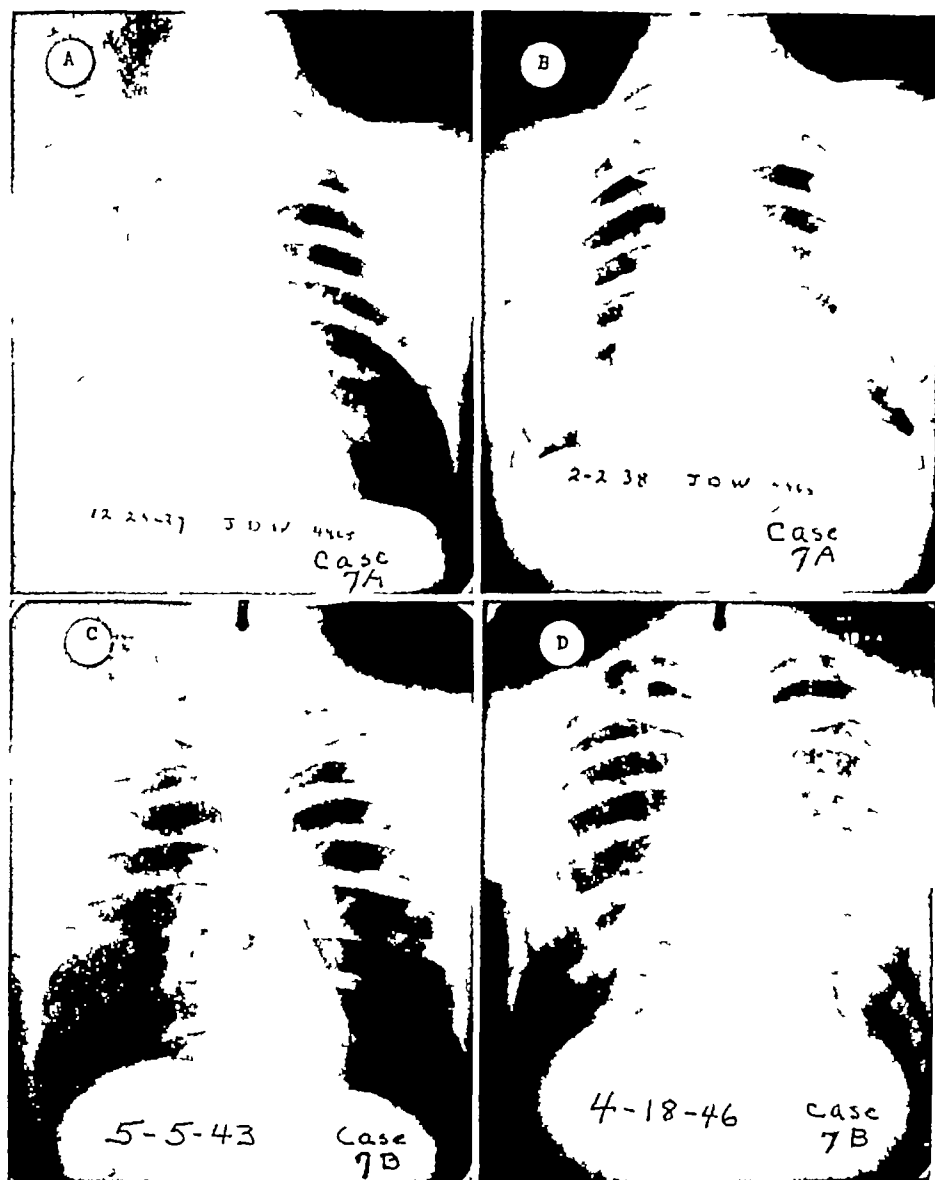


FIGURE 7, CASES 7A and 7B
Showing development of silicosis after removal from dust

According to Gardner¹³ from 20 to 30 per cent of people with silicosis ultimately die from heart failure that comes on suddenly and terminates in a few months and most of the rest succumb to tuberculosis. However other workers, particularly Sander,^{13a} have reported much lower figures. In Colorado it is our opinion that the percentage of cardiac deaths is slightly higher, and that of tuberculosis lower as a terminal event. This holds for those cases who have resided in Colorado most of their lives. We think this is also true of development of adult type tuberculosis in the non-silicotic individual, who resides in this area, as the climate, altitude, sunshine and lack of over-crowding, tend to lessen the liability of the development of the disease. This same contention was advanced by Henry Sewall¹⁴ and contributed to by other workers.^{15 16} Statistics are now being analyzed to test our theory but many factors interfere with making final conclusions. This observation may differ from other opinions due to the fact that the author confines his work to private practice and general hospitals rather than sanatoria that handle tuberculous cases only.

When tuberculosis does develop in the presence of silicosis we agree with Dayman¹⁷ that the constitutional reactions are not so pronounced as when tuberculosis alone is present. If a diagnosis is made early, the tuberculous lesion usually clears if proper care is instituted, as the following case illustrates.

Case 8 J.D. Born in Nebraska February 12, 1891 this man worked on a farm from 1906 to 1936. He was in a quartz mine from 1936 until November, 1942. On September 10, 1940 x-ray inspection revealed no evidence of silicosis (Fig 8a) but on January 6, 1942 the trunk and hilar shadows appeared enlarged and slight nodulation was seen (Fig 8b). On November 11, 1942 more nodulation appeared and a cavity was described in the left upper lung field (Fig 8c). The sputum contained acid fast bacilli. The only complaint was dyspnea. Following bed rest until February 1943 the cavity was not seen and sputum was negative for acid fast bacilli (Fig 8d).

A silicotic individual may develop tuberculosis with cavitation and have symptoms that are confused with advanced silicosis. Cough may develop with increasing dyspnea and the individual finally collapses from fatigue before tuberculosis is discovered as illustrated by the following case.

Case 9 W.J.S. On March 20, 1947 this patient gave a history of having worked as a quartz miner since February, 1933. On January 20, 1942 he was told he had advanced silicosis and advised to quit work. This he did in February, 1942. At this time he had shortness of breath on exertion but no cough. He then worked at an Arms Plant until January, 1944 and for the next seven months as a railroad brakeman. Following this he was a cab driver in Denver for eleven months and nine months in a war industry plant. In September 1945 he began work in a Terra Cotta plant where analysis revealed about 35 per cent free silica in the air.

Sixteen samples of the dust collected showed from 5 to 5½ million dust particles per cubic foot at the breathing zone of the cutting space. Air in other parts of the room contained 4,000,000 per cubic foot. This, according to the standards given previously, is not adequate to produce silicosis. In September, 1946 this man began to cough, have chest pain and raise sputum. These symptoms grew worse and on November 11, 1946 tuberculosis with beginning cavitation was found in both lungs, in addition to silicosis. The sputum revealed acid fast bacilli. He discontinued work on December 5, 1946. X-ray inspection showed evidence of diffuse nodular infiltration throughout both lung fields consistent with silicosis and in the mid-portion of each lung evidence of cavitation was seen (Fig 9a). On bed rest his cough decreased and he had no fever even



FIGURE 8, CASE 8

Showing the development of tuberculosis in a silicotic with subsequent healing

following a hemorrhage on March 6th. On March 24, 1947 the cavities appeared smaller (Fig 9b) and the sputum contained less than 10 tubercle bacilli per field. He appeared well.

Miners with silicosis often do not complain of symptoms until some accident happens, as the following case and some of the previous ones illustrate.

Case 10, A T C When examined December 13, 1937, this man of 52 years stated that he had worked in quartz mines most of his life. He had a back injury March 21, 1933 for which he was granted compensation. At that time he complained of shortness of breath and exhaustion which he said were not present before the accident. Examination revealed infected tonsils, increased bronchial breathing throughout the chest with few asthmatic wheezes, slight enlargement of the liver, advanced silicosis and enlargement of the heart to the left. Superimposed tuberculosis could not be excluded (Fig 10).

Prevention of Silicosis

As shown by Lanza,¹⁸ prevention of silicosis is entirely possible if engineering methods can be applied to control or remove the dust at its source. This is expensive, but "so is the provision of safe drinking water. People have been educated to spend enormous sums of money to provide safe drinking water but they have not learned to be as intelligent about providing a safe atmosphere to work in." Medical supervision is as essential in the prevention of silicosis as the installation of engineering controls. In some places it is almost impossible to entirely control the escape of silica dust into the atmosphere. Industry which has a silica dust

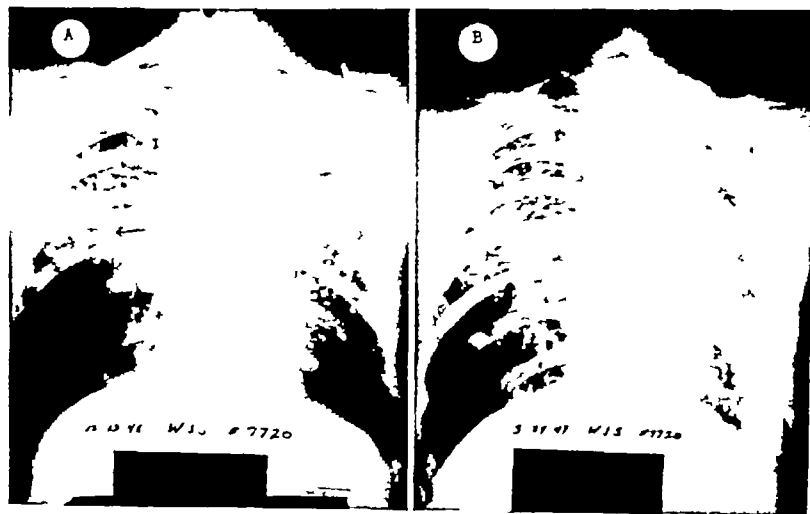


FIGURE 9 CASE 9

Showing development of tuberculosis in a far advanced case of silicosis

hazard should be under medical supervision. Although the actual supervision of safety measures must necessarily be the responsibility of competent foremen, experiences show that workmen quite often, despite medical and supervisory warning, will not take necessary precautions which are available to protect them from a dust hazard.

The medical department should see that workers have frequent chest x-ray inspection for evidence of early silicosis, and at the first sign of its development advise other employment. The physician should show the x-ray films to the worker and explain the condition. In this way Hamlin¹⁰ found the employees expressed an appreciation of the interest taken in them and better followed the physician's advice. Many had refused to wear respirators but when informed they evidenced new interest in the protection of their health. Our suggestion is that x-ray be more generally used in pre-employment and at regular intervals thereafter.

Laws are now in effect or are being passed in all states to allow workmen's compensation for silicosis. They might be established to permit the employer to dismiss a worker at once, without interference from the union, if he does not carry out safety rules.



FIGURE 10, CASE 10

Unfortunately we lack cooperation. If only the labor unions would realize that we are all on the side of humanity the path would be easy.

Treatment

In 1936 Denny, Robison and Irwing²⁰ reported that inhalation of finely divided metallic aluminum powder would inhibit the action of silica in the lungs of experimental animals. Gardner²¹ and his co-workers used hydrated alumina with good results both in inhibiting action of silica and the relief of symptoms in silicotic patients. There is some evidence, according to Gardner and others, that hydrated alumina may cause an increased susceptibility to tuberculosis, and should be used with caution. Bamberger²² concluded that hydrated alumina seems superior to the metallic powder for the treatment of silicosis. Research work on humans has been carried on at the University of Colorado School of Medicine since October 1945, by Dr. J. W. Berry²³ on the treatment of silicosis with hydrated alumina. A detailed report on results will soon be published.

Aluminum hydrate is now being used by some companies as a direct inhalation or dispersed into the atmosphere of change houses as a prophylactic measure before the men enter underground mines. However, since silicosis takes years to develop, it will require considerable time to determine whether the inhalations of aluminum dust or hydrated alumina will prevent the development of this disease in man.

All agree that the use of aluminum should in no way interfere with the engineering control and medical supervision of the dust hazard in industry. It may prove a great adjunct to the prevention of silicosis where the escape of silica dust into the atmosphere is difficult to control.

SUMMARY

- 1) The history, terminology and classification of silicosis are given.
- 2) The role of the size of the silica particle, the number per cubic foot of air, the concentration of silica in a free state, the time of exposure, the humidity of the working atmosphere, and the condition of the ciliated epithelium, as conditions influencing the production of silicosis are discussed.
- 3) Differentiation from other chest diseases is emphasized.
- 4) Serial periodic x-ray studies of men exposed to silica dust, showing their progression from one stage to another are presented.
- 5) Cases are included showing (a) The role of pre and post silicotic infection in the development of silicosis, (b) The peculiar

variability in the response of various workmen to silica dust during and after exposure, (c) That in some cases silicosis continues to develop even though the worker is removed from silica dust

6) Engineering and medical controls in the treatment and prevention of silicosis are discussed

RESUMEN

1) Se presenta la historia, terminología y clasificación de la silicosis

2) Se discute el tamaño de la partícula de sílice, numero de partículas por pie cubico de aire, la concentración de la sílice en estado libre, el tiempo de exposición, la humedad de la atmósfera en que se trabaja y el estado del epitelio cillado como condiciones que influyen la producción de silicosis

3) Se recalca su diferenciación de otras enfermedades del pecho

4) Se presentan estudios radiográficos seriados de hombres expuestos al polvo silíceo, que demuestran su progreso de una etapa a otra

5) Se incluyen casos que demuestran (a) el papel de la infección presilicótica y postsilicótica en la producción de la silicosis, (b) la variabilidad peculiar de la respuesta de diferentes trabajadores al polvo silíceo durante y después de la exposición, (c) que en algunos casos la silicosis continua desarrollándose aunque se aparta al trabajador del polvo silíceo

6) Se discuten los controles médicos y de ingeniería en el tratamiento y prevención de la silicosis

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Primary Atypical Pneumonia· Roentgenographic Course, Complications, Recovery Rate, and End Results*

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Many recent communications to the medical literature on primary atypical pneumonia have emphasized the difficulty of differentiating that disease from other pneumonic consolidations from the roentgenogram alone¹⁻⁶ It is generally recognized that the various pulmonary inflammations do, on x-ray examination, have a tendency to group types there are so-called "typical" pictures for pneumococcal lobar consolidation, for broncho-pneumonia, or for chronic Friedlander's bacillus pneumonia But the intergroup resemblance is so closely akin to the intragroup resemblance, with considerable overlap, that the usual inability or justifiable unwillingness of the roentgenologist to make an etiologic diagnosis of the acute pneumonic process on an x-ray film is immediately apparent

It has been shown, for example, by Stein and Kresky⁴ that in the early and resolving stages of pneumococcal pneumonia it is impossible to distinguish the infiltration from that of atypical pneumonia Lobar consolidations of non-pneumococcal origin occur frequently, as do segmental or lobular consolidations of both bacterial or virus origin Thus, it has been made increasingly clear that the nature of an acute pulmonary inflammation is a clinical problem The various clinical studies, bacteriologic studies of the sputum, laboratory examinations of the blood, including cold isoagglutinin studies, and when indicated, special skin tests, should determine the etiology The roentgenogram is then used to aid in determining the extent of the process, the efficacy of therapy, the rate of recovery, and the presence of complications and sequelae Once determining that a "pneumonia" is present, the roentgenologist's task is almost purely a descriptive one This, of course, excludes those cases of chronic pulmonary inflammations when the roentgenologist may be of inestimable aid in determining the ultimate diagnosis

A term used frequently is "pneumonitis" This is employed by some as generally synonymous with "pneumonia," by some as synonymous with primary atypical pneumonia, and by many as

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a diminutive, usually meant to indicate a "small area of consolidation" Because of this multiplicity of usages, it is suggested that the term "pneumonia" be solely employed to denote any parenchymal inflammatory process of bacterial, virus, Rickettsial, or unknown origin, exclusive of the nontuberculous mycotic diseases, tuberculosis, and frank pulmonary abscess

In some pulmonary diseases, notably tuberculosis, reasonably accurate predictions concerning the course of the disease, recovery rate and prognosis can be furnished by the roentgenologist on the basis of the roentgenographic characteristics of the lesion The present study of 1857 cases of pneumonia, occurring in a large Naval recruit training center, was made in an effort to determine whether, purely from a roentgenographic point of view, the distribution of involvement in primary atypical pneumonia of unknown etiology bears any relation to the course of the disease, the presence of complications, the rate of recovery, and the end results

Method From January 1, 1945 to July 31, 1946, 29,948 patients received diagnostic roentgenographic examinations by the x-ray Department Of this number, 1857 had a roentgenographic diagnosis of "pneumonia" From this number were discarded all those cases clinically diagnosed as lobar (pneumococcal) pneumonia, bronchopneumonia complicating the exanthemata, postoperative pneumonia, and all pneumonias of determined or undetermined origin lacking adequate follow-up studies to the conclusion of the disease This left a total of 855 analyzable cases of pneumonia clinically diagnosed as "primary atypical pneumonia of unknown etiology" These cases were all of males, ranging in age from 17 to 35 No attempt was made in this study to correlate the patient's age with the disease No deaths occurred in this series

As a routine procedure, all individuals having moderate or severe respiratory symptoms, with or without demonstrable abnormal physical signs in the chest, were examined by 14 x 17 chest roentgenograms In this way many clinically unsuspected cases of "small patches of consolidation" were uncovered especially during the months of February-May 1945 and December 1945-March 1946, when the incidence of primary atypical pneumonia at this station reached epidemic proportions Once a roentgenographic diagnosis of pneumonia was obtained, the patient was re-examined by x-ray at intervals of from 5 to 10 days (most usually every 7 days) until roentgenographic evidence of complete resolution was obtained This was performed despite clinical evidence of recovery No effort was made to correlate clinical evidence of recovery with radiographic recovery, but as a general observation, the former occurred earlier than the latter

When the findings on the original roentgenogram were equivocal, re-examination was performed in 48 to 96 hours. If there were clinical evidence of complications, recurrences, reinfections or "spreads," then re-examinations including oblique, lateral, and stereoscopic projections were obtained as indicated. Fluoroscopic examinations were performed in selected cases.

Findings According to the x-ray findings, these cases were placed into two main groups (Table 1) those showing unilobar involvement throughout the course of the disease, and those having multilobar involvement. The ratio of unilobar cases to multilobar cases was 4:4:1. Of the unilobar cases, the incidence of occurrence in the upper lobes and in the right middle lobe was almost equal, and by far, the majority of cases involved one of the lower lobes, with almost equal incidence in these cases. Of the multilobar

TABLE 1
DISTRIBUTION OF 855 CASES OF PNEUMONIA BY LOBE INVOLVED

	No. Cases	Per cent
1 <i>Unilobar Involvement</i> (including recurrences)		
A Right upper lobe	41	4.9
B Right middle lobe	48	5.6
C Right lower lobe	256	29.9
D Left upper lobe	59	6.9
E Left lower lobe	272	31.8
Unilobar Total	676	79.1
2 <i>Multilobar Involvement</i> (including re-infections and "spreads")		
A Both lower lobes	116	13.5
B Entire right lung	2	0.2
C Entire left lung	4	0.5
D All five lobes	4	0.5
E Other multilobar combinations	53	6.2
Multilobar Total	179	20.9
TOTAL	855	100.0

TABLE 2
RECURRENCES

No. Cases	Lobe Involved	Average Time of Recurrence	Average Clearing Time
9	Right lower	14 days	22.0 days
1	Right middle	7 days	11.6 days
1	Left upper	6 days	17.1 days
7	Left lower	17 days	24.8 days

cases, involvement of both lower lobes predominated. Seventy-five and two tenths per cent of the 855 cases involved one or both lower lobes.

The entire right lung was involved only twice, and the entire left lung was involved 4 times. All five lobes were involved in 4 cases, and all other multilobar combinations occurred in 53 cases.

In 18 cases, an incidence of 2.1 per cent recurrences occurred. For the purpose of this study, a recurrence was defined as a reconsolidation of the same lobe or portion of the lobe during resolution, or re-consolidation after resolution but before complete subsidence of clinical signs or symptoms. A patient, once discharged as recovered, was treated as a new case if he developed pneumonia after radiographic and clinical recovery. Table 2 shows the number of cases, location, average time of recurrence after initial roentgenographic diagnosis of pneumonia was made, and the average total clearing time.

In 27 cases, or 3.1 per cent, reinfections or "spreads" occurred. A reinfection, or "spread" was defined as involvement of one or more originally uninvolved lobes during the disease, or after roentgenographic resolution but before subsidence of clinical signs or symptoms. In 13 of the 27 cases thus recorded (Table 3) "spread" occurred from one lower lobe to the other.

Complications occurred in 108 cases (Table 4). Pleurisy, as evidenced by parietal pleural thickening, interlobar septal thickening, and blunted costophrenic angles, but without evidence of free pleural or interlobar fluid occurred 35 times, or in 4.1 per cent. Free pleural fluid was present in 58 cases, 53 of which were with ipsilateral pneumonia, 3 with contralateral pneumonia, and in 2 cases bilateral effusion occurred. In 12 cases unilateral effusion occurred with bilateral pneumonia.

When, in the course of a pneumonia, a contralateral effusion occurred, as in the above mentioned 3 cases, as well as in the 2 cases of bilateral effusion, there arose the question of "idiopathic" pleural effusion of tuberculous origin. All 5 such cases promptly

TABLE 3
RE-INFECTIONS OR 'SPREADS'

No. Cases	Original Site	Re Infection or "Spread" Site	Average Time After Initial Onset	Average Clearing Time
9	right lower	left lower	7 days	20.2 days
4	left lower	right lower	10 days	25.1 days
14	all other combinations		12 days	23.4 days

recovered, the period of observation was limited only to the acute process, but it was reasoned clinically that the effusion was purely on the basis of the inflammatory process, and thus the patient was released to duty when clinically and roentgenologically recovered. Re-examination at a later date was usually suggested.

Interlobar effusion was present 4 times, once in the left septum, once in the right major septum, and twice in the minor septum. Loculated pleural fluid developed twice, in both cases on the right side.

Partial atelectasis occurred 5 times, an incidence of 0.5 per cent. Partial atelectasis of the right lower lobe occurred twice, and there was one case each involving the right upper, right middle, and left lower lobes. One case of complete atelectasis of the right lower lobe occurred.

Movitt⁷ has reported two cases of spontaneous pneumothorax in adults with pneumonia. This complication, producing a 30 per cent collapse of the right lung, occurred in one case of right lower lobe pneumonia. Pericardial effusion, observed clinically and roentgenographically, was present in one case. One case of spon-

TABLE 4
COMPLICATIONS

A	Pleurisy		35
B	Free pleural effusion		58
	1 Ipsilateral		53
	a With contralateral pneumonia	12	
	b Without contralateral pneumonia	41	
	2 Contralateral		3
	3 Bilateral		2
C	Interlobar effusion		4
	1 Left		1
	2 Right major		1
	3 Right minor		2
D	Loculated pleural fluid (right)		2
E	Atelectasis		6
	1 Partial		5
	a Right upper lobe	1	
	b Right middle lobe	1	
	c Right lower lobe	2	
	d Left lower lobe	1	
	2 Complete, right lower lobe		1
F	Others		3
	1 Subcutaneous emphysema		1
	2 Pneumothorax, right		1
	3 Pericardial effusion		1
COMPLICATIONS TOTAL			108

taneous subcutaneous emphysema occurred, and is reported in detail below

Infiltrations of an acute pneumonic nature, especially in the upper portions of the lung fields, have frequently been confounded with active tuberculosis.¹⁸ Lesions of primary atypical pneumonia frequently resemble the "typical" soft exudative reinfection apical or subapical tuberculous process. These are seen in serial films to resolve with the expected rapidity of a pneumonia, under proper therapy. Reinfection tuberculosis was thus suspected 35 times in this series. Twenty-one cases of right upper lobe pneumonia, and 14 cases of left upper lobe pneumonia were acid-fast suspects. None, after intensive clinical and laboratory studies, proved to be tuberculosis. All lesions resolved completely. No case of active tuberculosis was present in the entire series.

The end results are shown in Table 5. Of these cases 90.0 per cent had roentgenographically completely normal lung fields, without evidence of permanent or semi-permanent changes. Four and nine tenths per cent retained parietal pleural thickenings (as evidenced by visceroparietal diaphragmatic "tentings," thickening of the axillary pleura, or blunted costophrenic sinuses). Interlobar pleural thickenings remained in 6 cases, and localized parenchymal fibrotic changes remained in 12. These latter categories should possibly have had further roentgenographic studies at a later date to determine whether such changes that were

TABLE 5
END RESULTS

Findings	No. Cases	Per cent
Completely normal lung fields	778	90.9
Parietal pleural thickenings	42	4.9
Left lower lobe pneumonia	23	
Right lower lobe pneumonia	17	
Interlobar pleural thickenings	6	0.7
Left upper lobe pneumonia	2	
Right middle lobe pneumonia	3	
Right lower lobe pneumonia	1	
Localized fibrotic changes	12	1.4
Right lower lobe pneumonia	5	
Left lower lobe pneumonia	7	
Suspected (unproved) bronchiectasis	13	1.6
Bronchiectasis	4	0.5

demonstrated were of a permanent or semi-permanent nature, such studies, however, were impracticable because of the brevity of the training period for these men, and were, in general, only suggested in the patient's medical record for the cognizance of his future medical officer

Suspected bronchiectasis posed some unusual problems Prolongation of the clearing time, especially in lower lobe pneumonias, coupled with clinical evidence of protracted respiratory infection usually aroused suspicion Equivocal or deceiving findings in bronchography during or soon following a severe acute respiratory infection have led to the recognition of so-called "pseudo-bronchiectasis" Bronchography was thus not attempted until good and sufficient proof existed clinically that the disease had progressed into a subacute or chronic process, and roentgenographically that little or no progress toward resolution was taking place Bronchography therefore was postponed until 30-60 days had elapsed after the onset of the illness Four cases of bronchiectasis, an incidence of 0.5 per cent, were obtained Thirteen others were suspected, but unproved, and after a prolonged hospitalization and convalescence they recovered, the recommendation that further studies at a later date be instituted, if indicated, was usually made (Table 6) The 4 cases of bronchiectasis represent the only cases not returned to their Naval duties as cured (Table 7) Re-examination at a later date was advised to determine the permanency of the bronchiectasis^{8,9}

Cases discharged as recovered numbered 851 Table 8 shows the analysis of these cases, with reference to man-days of roentgen-

TABLE 6
SUSPECTED BRONCHIECTASIS

Location	Complication	No. Cases	Man-Days Clearing	Average Clearing Time
Right lower lobe	None	4	252	63.0 days
Left lower lobe	None	3	131	43.7 days
Both lower lobes	None	2	97	48.5 days
Right middle lobe	None	1	49	49.0 days
Both lower lobes	Pleural effusion	1	55	55.0 days
Right lower lobe	Pleural effusion	1	48	48.0 days
Left lower lobe	Pleurisy	1	88	88.0 days
TOTAL		13	720	
AVERAGE CLEARING TIME				55.4 days

TABLE 7
BRONCHIECTASIS

Location	Complication	Duration Before Diagnosis Made	Type of Bronchiectasis
Right lower lobe	None	66 days	Cylindrical
Left lower lobe	None	69 days	Cylindrical
Left lower lobe	Pleural effusion	71 days	Cylindrical
Left lower lobe	Subcutaneous emphysema	68 days	Saccular

TABLE 8
CLEARING TIME ANALYSIS

Site	Cases of Uncompl-icated Pneumonia	Man-Days of Clearing	Average Clearing Time (days)	Cases of Pneumonia and Pleurisy	Man-Days of Clearing	Average Clearing Time (days)
Right upper lobe	41	658	16.0	0	0	
Right middle lobe	46	612	13.3	0	0	
Right lower lobe	233	3523	15.1	12	203	16.9
Left upper lobe	53	678	12.8	1	12	12.0
Left lower lobe	240	3430	14.3	9	209	23.2
Both lower lobes	99	1690	17.1	5	91	18.2
Others	47	602	12.8	8	163	20.4
TOTAL	759	11193		35	678	
Average Clearing Time (days)			14.7			19.4

Table 8 (Continued)

Site	Cases of Pneumonia and Effusion	Man Days of Clearing	Average Clearing Time (days)	Total Cases	Total Man Days	Average Clearing Time (days)
Right upper lobe	0	0		41	658	16.0
Right middle lobe	2	36	18.0	48	648	13.5
Right lower lobe	10	154	15.4	255	3880	15.2
Left upper lobe	5	147	29.4	59	837	14.2
Left lower lobe	20	322	16.1	269	3961	14.8
Both lower lobes	12	249	20.7	116	2030	17.5
Others	8	190	23.8	63	955	15.2
TOTAL	57	1098		851	12969	
Average Clearing Time (days)			19.3			15.2

ographic clearing time, and the average clearing time. These cases were placed in three groups: those with uncomplicated pneumonia, those with pneumonia and pleurisy, and those with pneumonia and pleural effusion, all in relation to the lobar distribution of the pneumonic process. Of course, the actual duration of the pneumonia before roentgenography in any individual case could not be determined, similarly, since it obviously was impractical to obtain films at intervals more frequent than 5-10 days, the actual day of resolution could not be determined either. It was reasoned that these two incalculable factors would naturally balance each other, and thus they are neglected in this study. Clearing time by x-ray, from the time the lesion was first discovered, was found to take any time from 2 to 88 days. No significant difference in clearing time for uncomplicated pneumonias in relation to the lobe involved was found, except for bilateral lower lobe involvement which took an average of 24 days more to clear. Approximately 5 days longer on the average was required for resolution if pleurisy or effusion occurred. No significant over-all difference in average clearing time for all cases, with and without complications, in relation to the lobe involved, occurred. A general over-all average of 15.2 days was required for x-ray resolution for the entire series of 851.

CONCLUSIONS

The distribution of involvement of primary atypical pneumonia apparently bears no startling statistical relation to the course of the disease, including the incidence of recurrence and reinfection, and thus there is little predictability in any individual case. Seventy-five and two tenths per cent of the cases involved one or both lower lobes. The general over-all average roentgenographic recovery rate for 851 recovered cases was 15.2 days, for uncomplicated pneumonia 14.7 days, for pneumonia with pleurisy 19.4 days, for pneumonia with effusion 19.3 days. Pleurisy did not occur with right upper or middle lobe pneumonias, and only once with a left upper lobe pneumonia. Effusion did not occur with right upper lobe disease, and only twice with right middle lobe involvement (4.2 per cent), but with the same incidence as in right lower lobe pneumonia. Bronchiectasis was suspected 13 times (12 in lower lobe involvements) and proved 4 times, 3 in the left lower and 1 in the right lower lobe. Seven hundred and seventy-eight cases, 90.9 per cent, had completely normal roentgenograms on recovery, minor postinflammatory changes were present in 60 cases, and these were exclusively the result of lower lobe pneumonias. Bronchiectasis in 4 cases was confined to the lower lobes.

CASE REPORT

W J S, an 18 year old white male Naval recruit was admitted on April 25, 1946 complaining of malaise, coryza, dryness of the throat, and a cough of two weeks' duration. The cough had been treated symptomatically for one week but had become progressively worse and was associated with slight dyspnea on effort. No chest pain was present and he had experienced no recent chest trauma. The cough was only slightly productive of non-bloody non-frothy mucoid sputum. A 35 mm photo-fluorographic chest film in March 1946 on enlistment, was negative. The past history was non-contributory. Physical examination revealed a temperature of 101 degrees F, pulse rate of 110, respiratory rate of 22. There was no cyanosis. Subcutaneous crepitus was demonstrated on both sides of the neck, shoulders and upper thorax anteriorly and posteriorly. Moderate injection of the pharynx was present. Diminished breath sounds, slight increase in tactile fremitus, and scattered moist rales were present in the left chest posteriorly below the scapula and in the axilla. The heart was normal, except for tachycardia. The remainder of the physical examination was not remarkable. The findings were considered inconsistent with a spontaneous pneumothorax and consistent with an atypical pneumonia. The red blood cell count was 4,206,000 per cmm, with 13.0 gm hemoglobin. The white blood cell counts ranged between 10,500 and 12,700 per cmm, with a normal differential count. The urinalysis was normal.

Chest x-ray examination on admission revealed a flocculent increased density at the left base and behind the left heart border. No evidence of pneumothorax was present. No fracture of the rib cage was visualized. The heart and mediastinal structures were normal in size and contour. A fairly marked subcutaneous emphysema of the soft tissue planes of the neck, supraclavicular regions and the upper portions of each side of the thorax was present.

It was assumed that a spontaneous pneumothorax had occurred during the period of ambulatory treatment, and that it had absorbed before the initial roentgenogram was obtained. It was reasoned further that the point of the pneumothorax occurred where the visceral and parietal pleura were both densely adherent to the chest wall in order for air to escape into the tissue planes. The subcutaneous emphysema disappeared in 5 days and the patient became afebrile in 4 days. Partial resolution of the pneumonic process occurred until May 31, 1946. 36 days later. Thereafter, no further clearing of any significance occurred. The patient began to experience paroxysms of violent coughing which gradually became productive of mucoid and mucopurulent sputum. The sputum was never copious. No acid-fast bacilli were found on repeated examinations. On the 57th day bronchiectasis was entertained as a roentgenographic diagnosis. Repeated short febrile episodes thereafter delayed bronchography until the 68th day. Instillation of iodized oil into the bronchial tree revealed saccular bronchiectasis of the axillary and posterior branches of the left lower lobe bronchus.

SUMMARY

This study is a statistical analysis of 855 cases of primary atypical pneumonia of unknown etiology. It was undertaken to determine whether, from a roentgenographic point of view, reasonably

Functional Examination of Each Lung Before and After the Paralysis of the Phrenic Nerve*

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In a previous work we started the study of the influences of different methods of collapse-therapy—and particularly pneumothorax—on the respiratory function of each lung. We are presenting here the results of the air content analysis of each lung before and after the surgical paralysis of the phrenic nerve. Gianotti and Ceruti² have seen in tracheotomized dogs that the ventilation of the lungs and the oxygen consumption diminishes after the excision of the phrenic nerve and that these effects persist after several weeks. The reduction in the respiratory values is somewhat higher in the bilateral than in the unilateral paralysis. Brea and Ferrari³ made a functional study of seven cases of pulmonary tuberculosis before the paralysis of the phrenic nerve and also a few days and again one month after the surgical paralysis (by excision, alcoholization or crushing). After a few days they found a diminution of the voluntary apnea, the vital capacity, the respiratory volume per minute, the oxygen consumption, CO₂ elimination, and in the O₂ content of the alveolar air. Due to the development of compensatory mechanisms all these changes return to normal values one month after the intervention. Cournand and Richards,⁴ in eight cases of therapeutic phrenic paralysis found striking impairment of the pulmonary function, as evidenced by decreased breathing reserve, unsaturation of arterial blood and a distinct tendency to pulmonary congestion after intravenous infusion. According to Rossier, Petzold, Decker and Michaud, cited by Steinlin,⁵ the paralysis of phrenic nerve results in an unsaturation of arterial blood during moderate work and sometimes even during rest. To explain this finding it is suggested that although there is a reduced ventilation, the amount of blood circulating through the lower part of the homolateral lung remains constant. A pendular phenomenon in the air of lungs due to the paradoxical movement of the diaphragm has also been described.

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Bronchspirometric examinations in patients with surgical paralysis of the phrenic nerve were effected by Jacobaeus⁶ (1 case) and by Pinner, Leiner and Zavod⁷ (3 cases). Jacobaeus observed marked reduction of the ventilation, of the O_2 consumption and the diminution of CO_2 . We believe that a bronchial obstruction existed which annulled nearly completely the functional value of the corresponding lung. Pinner, Leiner and Zavod admit that the paralysis of the phrenic nerve may have a considerably disfavoured effect on the pulmonary function.

Technique

Functional examination of the separate lungs was performed in ten cases of pulmonary tuberculosis (seven males and three females) before and after the therapeutical paralysis of the phrenic nerve obtained by excision (3 cases), alcoholization (3 cases), crushing (3 cases) and phrenicotomy (1 case). In seven cases phrenic paralysis was produced on the right side and in the three others on the left. Functional studies were performed a few days before the intervention and between one and two months afterwards, except in two cases which were studied four and five months later respectively. The specific timing of the examinations was selected in order to eliminate the influence of the favorable or unfavorable progress of tuberculous lesions on the results and in this way to record only the differences due to the phrenic paralysis. We did not perform the examination immediately after the operation because we wished to avoid the immediate disequilibrium usually following surgery and to permit the motor, sensory, vascular and trophic changes due to the phrenic paralysis to develop. Furthermore, with the study of each lung we could avoid any error produced by compensation of the other lung. The aim of our study was the observation of the more permanent physiological changes which occur after phrenic paralysis.

The bronchspirometric examination was performed with the Gebauer's and Zavod's gauges using the technique described by Vaccarezza and colleagues.⁸ With the patient in sitting position the following indices were determined: vital capacity, complementary air reserve air respiratory volume, oxygen consumption and equivalent of ventilation.

For the comparative study of the results before and after surgical intervention the relative values of the different indices were determined for the separate lungs. We did not use the absolute values because these may be altered in each determination by the emotional reaction of the patient or by the anaesthesia. Comparative values between lungs are valid because in each analysis both lungs were examined under the same conditions.

Results

The paralysis of the phrenic nerve produced in all cases (see Table I), a reduction of the bronchiopyrometric indices of the corresponding lung with exception of the complementary and the reserve air, which in some cases even showed an increase

The diminution in O_2 consumption was very marked (41.7 per cent). This means that the phrenic paralysis reduces almost to half the oxygen uptake of the blood in the corresponding lung

The respiratory volume was diminished in all cases with the exception of case 7 in which a slight increase was observed. The mean of the total observations shows a reduction of 17.7 per cent.

The vital capacity was also reduced in all cases with the exception of number 6 in which almost no change was demonstrated, the mean being 14.9 per cent. The complementary and the reserve air had a mean diminution of 14.7 per cent and 19.6 per cent respectively. However considering that both indices are included in the vital capacity (and this never increases), the small increments found in such cases are only apparent. This fact can be easily explained if one recognizes that during the examination many patients, because of the anaesthesia or due to emotional factors, vary the degree of thoracic breathing from one determination to the next. This fact may, of course, affect the relative values of the components of the vital capacity, especially in relation to the complementary and reserve air.

TABLE I
Percentage of the Reduction in the Bronchiopyrometric
Factors After Paralysis of the Phrenic Nerve

Observations	Vital Capacity	Complementary Air	Reserve Air	Respiratory Volume	Oxygen Consumption
1				18.5	59.7
2	11.7	60.3	21.2	5.2	64.1
3				22.2	60.2
4	10	+14.3	42.3	16.9	31
5	21.6	20.5	38.5	12.1	31
6	+ 2	+36.5	+16.2	60.5	52.9
7	7	34.6	8	+ 4.4	21
8	28.4	28.5	55.4	18.5	27.8
9	24.9	42.5	8.3	11.3	40.4
10	18.2	+17.4	42.3	16.4	29.7
Mean of the percentage of reduction	14.9	14.7	19.6	17.7	41.7

The equivalent of ventilation increased in all cases with the exception of case 6. This functional deterioration indicates the more marked reduction of the oxygen consumption in relation to the respiratory volume. The decrease in values of the different indices are as follows: (1) oxygen consumption, (2) reserve air, (3) respiratory volume, (4) vital capacity and (5) complementary air.

Discussion

Changes observed in the different bronchiospyrometric indices show no strict relationship to the intensity of the diaphragmatic ascension. This is particularly manifested in cases 2, 3, 6 and 10.

One interesting fact is that the phrenic paralysis affects in a much higher degree the oxygen consumption than the other indices which are expressions of the function of ventilation. This predominating effect on the oxygen uptake of the blood can not then be explained on the basis of the unilateral paralysis of the diaphragm only.

It is known that the phrenic nerve has connections with the cervical sympathetic and the solar plexus and that it contains non-myelinated fibers. These two facts may indicate that this nerve has vasomotor effects on the pulmonary circulation, and this may explain why its section should produce important changes in the blood supply of the lung. It would be very interesting to determine the cause of this diminution in blood supply and the correlated diminution in oxygen consumption. To achieve this end, laborious experimentation which is beyond the scope of the present work would be necessary.

The differences observed between the two bronchiospyrometric examinations together with the short time elapsed between the phrenic paralysis and the second examination permit us to discard the presence of compensatory phenomena in the corresponding lung. In our studies of the separate functional characteristics of each lung such compensation was not observed. This compensation was however found by Brea and Ferrari³ by examining both lungs together.

We do not want to extend our discussion to the clinical importance of these observations. However it seems very interesting to compare the results here observed with those found after the artificial pneumothorax. Paralysis of the phrenic nerve reduces to nearly half the functional value of the corresponding lung. Pneumothorax almost always improves the equivalent of ventilation of the collapsed lung due to a smaller reduction in oxygen consumption in relation to the respiratory volume.

SUMMARY

Separate functional examinations of each lung were performed in ten patients with pulmonary tuberculosis before and after the paralysis of the phrenic nerve

In the lung on the paralyzed side the following percentage of diminution of bronchospymetric values were observed oxygen consumption 41.7, reserve air 19.6, respiratory volume 17.7, vital capacity 14.9, complementary air 14.7

Due to the marked reduction in oxygen consumption in relation to the lesser reduction in respiratory volume the equivalent of the ventilation is frankly impaired

The surgical paralysis of the phrenic nerve reduces almost to half the functional value of the corresponding lung

RESUMEN

Se llevaron a cabo exámenes funcionales separados de cada pulmón en diez tuberculosos pulmonares, antes y después de la parálisis del nervio frénico

En el pulmón del lado paralizado se observaron los siguientes porcentajes de disminución de los valores broncoespirométricos consumo de oxígeno, 41.7, aire de reserva, 19.6, volumen respiratorio, 17.7, capacidad vital, 14.9, aire complementario, 14.7

Debido a la decidida reducción en el consumo de oxígeno en relación a la menor reducción en el volumen respiratorio, el equivalente de la ventilación está francamente perjudicado

La parálisis quirúrgica del nervio frénico reduce casi a la mitad el valor funcional del correspondiente pulmón

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Photofluorographic Survey of 33,971 Apparently Healthy Persons in Greece

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INTRODUCTION

The present paper includes the first results of a survey carried out by the Photofluorographic Center established at the Rizarion School in Athens. This survey has been of very great importance for Greece, in view of the unreliability of the tuberculosis mortality statistics, and in view of the fact that the law of compulsory notification of infectious diseases does not apply to tuberculosis in Greece. The establishment of the Athens photofluorographic center at the end of 1945 can be considered to be a pioneering effort in public health in Greece. Since April 1946, a second dispensary has been operating in Salonika, both centers being under the direction of the Central Committee for investigation of the Incidence of Tuberculosis in Greece.

Up to the end of 1946, the Athens Center has examined 70,000 persons and the Salonika Center 20,000. In addition, a Mass X-Ray Survey Center established by the Tuberculosis Section of UNRRA during the summer of 1946 examined 10,000 persons in Patras. Surveys are carried out by examining apparently healthy groups, i.e. personnel of the Armed Forces, of Educational Institutions, of the Public Services, of mixed enterprises and factories and special groups. A 35 mm miniature film is taken in the first place, and of those examinees whose films exhibit suspected pulmonary tuberculosis a large x-ray film is then taken, and the final diagnosis is made on the basis of the large film, combined with a clinical examination of the individual. Definite tuberculous examinees are then notified and informed about their condition, and receive pertinent advice.

The Athens Center conducts its own follow-up of suspects and of definite cases because Greek State Dispensaries lack the means and the modern organization which are necessary for properly carrying out this service. Unfortunately, no laboratory facilities are available in the Athens Center for carrying out such tests as examination of sputum, blood sedimentation rates, etc. However, it is hoped that with the establishment of the Institute for Chest

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Diseases in Athens, which will incorporate the Photofluorographic Center, this need will soon be fulfilled

Clinically significant cases are those of active pulmonary tuberculosis, the diagnosis of which is based upon the physical, x-ray, and laboratory findings. The clinically significant cases are subdivided into observation and treatment cases. Observation cases are limited to those which present no physical findings, and wherein the x-ray film demonstrates evidence of productive lesions tending towards fibrosis. The fact that each clinically significant case has been checked very carefully by our service gives special importance to our findings. The clinically insignificant cases consist of those whose x-ray film shows fibrotic or fibro-calcified lesions due to reinfection tuberculosis. Cases of healed primary lesions are not included among them.

This study includes the result of the mass survey of 33,971 persons belonging to apparently healthy groups of urban population. These groups are classified into six categories, according to their occupation.

The first category is composed of groups of the Armed Forces which were divided into three subgroups. The first subdivision consists of groups of candidates for the military schools, the second consists of cadets who successfully passed a physical examination.

TABLE I
M A L E S

Ages	Examined	Clinically Significant Cases						Total of Clinically Significant Cases	Non Clinically Significant Cases	Total Clinically & Non-Clinically Significant Cases
		Treatment			Observation					
		Min	Mod Adv	Adv	Min	Mod Adv	Adv			
15-19	2017	12	14	2	11			39	62	101
20-24	11173	79	78	7	76	6	1	247	352	599
25-29	4153	30	39	4	20	2		95	217	312
30-34	2736	40	42	4	25	8		199	187	306
35-39	2377	27	34	8	28	3		100	187	287
40-44	1839	30	28	3	26	3	1	91	177	268
45-49	1308	21	22	7	20	2		72	148	220
50-59	1362	27	42	10	18	8	1	106	169	275
60-69	458	7	16	2	3	1		29	61	
70 & over	37		2					2	2	4
TOTAL	27460	273	317	47	227	33	3	900	1562	2462

TABLE II
F E M A L E S

Age	Examined	Clinically Significant Cases						Total of Clinically Significant Cases	Non Clinically Significant Cases	Total Clinically & Non Clinically Significant Cases
		Treatment			Observation					
		Min.	Mod Adv	Adv	Min	Mod. Adv	Adv			
15-19	910	4	5	1	5	1		16	32	48
20-24	1900	14	18	4	15	4		55	79	134
25-29	1282	12	13	8	16	3		52	91	143
30-34	825	8	6	1	4	1		20	65	85
35-39	582	2	4	2	9	2		19	61	80
40-44	404	4	4	1	3			12	51	63
45-49	276	3	1	1	5			10	30	40
50-59	265	2	1		1	1		5	36	41
60-69	61		2					2	10	12
70 & over	6								2	2
TOTAL	6511	49	54	18	58	12		191	457	648

TABLE III
B O T H S E X E S

Age	Examined	Clinically Significant Cases						Total of Clinically Significant Cases	Non Clinically Significant Cases	Total Clinically & Non Clinically Significant Cases
		Treatment			Observation					
		Min	Mod Adv	Adv	Min.	Mod Adv	Adv			
15-19	2927	16	19	3	16	1		55	94	149
20-24	13073	93	96	11	91	10	1	302	431	733
25-29	5435	42	52	12	36	5		147	308	455
30-34	3561	48	48	5	29	9		139	252	391
35-39	2959	29	38	10	37	5		119	248	367
40-44	2243	34	32	4	29	3	1	103	230	333
45-49	1583	24	23	8	25	2		82	178	260
50-59	1627	29	43	9	19	9	1	110	205	315
60-69	519	7	18	3	3	1		32	71	103
70 & over	43		2					2	4	6
TOTAL	33971	322	371	65	285	45	3	1091	2021	3112

shortly before they were x-rayed by our team The third consists of the regular personnel of the Armed Forces

The second category is composed of groups of students, the third category of personnel of the Public Services, the fourth category of personnel of "mixed enterprises" (i.e. Oil Companies, Telephone, Water supply, Electric Railways and Gas Companies) The fifth category is composed of factory groups and the sixth of special groups such as displaced persons, prisoners, registered prostitutes, etc

The following tables, I to III, illustrate our statistical findings of the total of examinees, broken up into sex and age

In analysing our findings, the following interesting facts come to light

1) Tuberculosis Incidence among the total of Examinees

The survey included 33,971 persons, 6,511 females and 27,460 males Tables I, II and III show the result on the total of examinees according to sex and age Of the entire number 1,091 were found to be clinically significant cases of pulmonary tuberculosis, 900 males and 191 females Although the males constituted 80.9 per cent of the examinees they provided 82.4 per cent of the clinically significant cases

In males, the incidence curve of tuberculosis increases with age whereas in females the highest rates are observed in age groups,

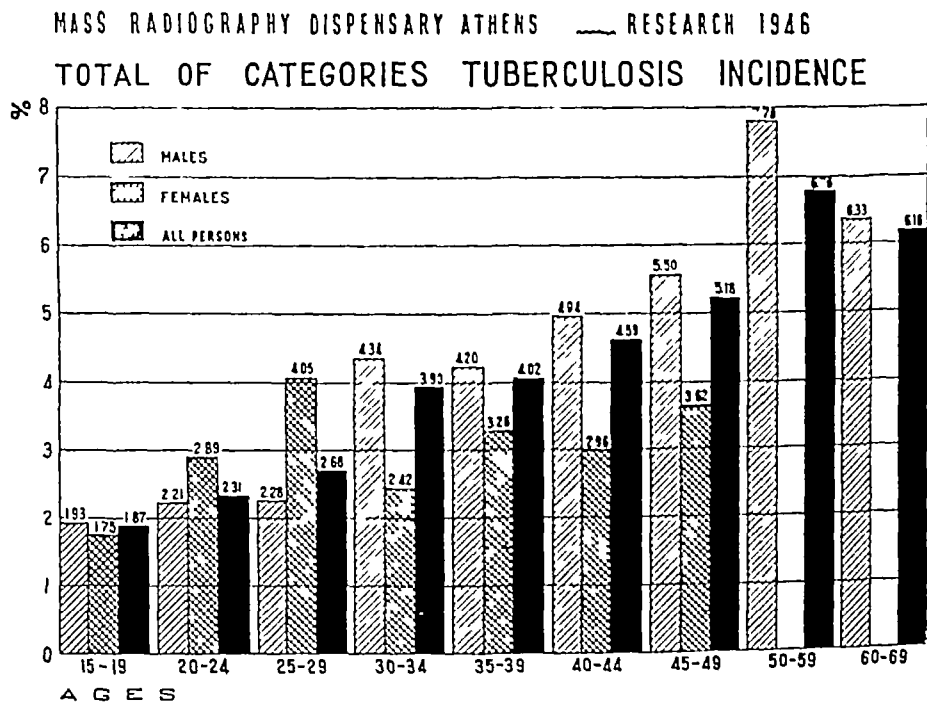


CHART I

20 to 30 Although the curve in the older age groups shows certain rises in the case of females, it is nevertheless always lower than the curve of incidence in males The lower incidence among females in the age groups 35 to 50, compared with the higher curve for males is probably explained by the fact that females in these age groups are not engaged in occupations outside their homes

Incidence figures for males (in age groups) similar to these discovered in Athens have been found through mass radiography surveys by Edwards in 1940 and by Elkin, Irwin and Kurzhalz in 1946, in the United States In our survey, the average age of the examinees was 29.5 years and that of the clinically significant cases was 33.7 years

2) Tuberculosis Incidence among the different Categories

Differences in tuberculosis incidence were observed among the various categories Chart II shows the incidence in our six categories from the highest to the lowest figures Thus the category of "Armed Forces Personnel" with 13,582 examinees shows the lowest incidence, 209 clinically significant cases, i.e. 1.54 per cent In the category of "Educational Institutions" with a total of 3,658 examinees, we find 124 clinically significant cases, i.e. 3.38 per cent The "Public Service" category with a total of 6,382 examinees included 295 such cases, i.e. 4.62 per cent The category of "Mixed Enterprises" with a total of 4,889 examined persons produced 243

MASS RADIOGRAPHY DISPENSARY ATHENS — RESEARCH 1946
TUBERCULOSIS INCIDENCE

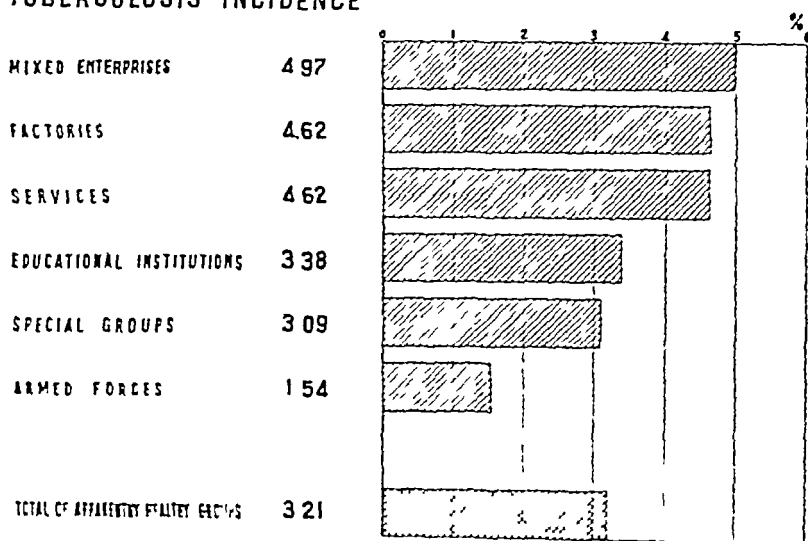


CHART II

cases, i.e. 4.97 per cent. The "Factories" category with 3,328 examinees provided 154 cases, i.e. 4.62 per cent. Finally, the sixth category containing the "Special groups" yielded 66 cases out of a total of 2,132 examinees, i.e. 3.09 per cent.

The comparatively low incidence found in the "Armed Forces" category (1.54 per cent) can be attributed to the strict physical examination to which the Army personnel are subjected at the time of recruitment, to the medical supervision received while in service and to the immediate dismissal from the Army of all detected cases of tuberculosis.

The relatively high mean incidence in the "Educational Institutions" category (3.38 per cent) is in keeping with the high incidence observed among the applicants for the University (3.28 per cent). One is greatly impressed by the high incidence found among the students of the Polytechnical School (5.10 per cent) which may be explained by the facts that: a) no medical examination is required of the students before their admission to the school, b) known tuberculosis cases are not removed from the school by the educational authorities and the disease is thus allowed to spread from the affected students to their fellows, c) the program of studies is exceedingly heavy.

Candidates for the University (3.28 per cent) and for the Cadet Schools (1.82 per cent) are in the same age group. The great differences in incidence rates between them may be explained by the fact that the cadets know that they must undergo a strict physical examination before being admitted to the Cadet Schools and therefore, possibly, apply a process of self elimination if they are cognizant of any disqualifying conditions obtaining among themselves.

In the "Public Services" category (4.62 per cent), the highest incidence was observed among employees of the Institute of Social Insurance (5.40 per cent). Bank of Greece employees also provided a relatively high incidence rate (4.24 per cent). In this latter group the highest incidence was found among personnel working in the underground offices of the Bank and at the counters where used bank notes are handled. The lowest incidence in this category was observed among the Greek employees of UNRRA (3.04 per cent).

In the category of "Mixed Enterprises" (4.97 per cent), the highest incidence was observed among the personnel of the Shell Oil Company (7.19 per cent). This incidence is in keeping with their high tuberculosis mortality rate (nine deaths from tuberculosis within two years, from the liberation in October 1944). The lowest incidence in this category was found among the personnel of the Gas Company (2.80 per cent).

In the "Factories" category (4.62 per cent), the highest incidence was observed in the Calyx Ammunition factory group (6.57 per cent) and the lowest among the personnel of the Eniourgia Textile Factory (3.91 per cent)

The striking variations in incidence observed between various groups within the 3rd, 4th and 5th categories are related to the kind of occupations, the medical supervision obtaining in these groups and, in the case of some enterprises, to the immediate dismissal of known cases of tuberculosis

The comparatively low mean incidence in the sixth category containing the special groups (3.09 per cent) was greatly influenced by the low rates found among registered prostitutes

The highest rate was observed among displaced persons (13.67 per cent). Unfortunately, our survey of Displaced Persons only includes a small number of examinees because when our team began to operate, most of the Displaced Persons had returned to their homes. Nevertheless, although the number of examinees was small, we considered the data reliable in view of the results recorded in other countries which were similar, when relatively large numbers were surveyed

Comparing our figures with those obtained among similar groups in England and the United States, it is obvious that higher incidence rates are to be found among all groups in Greece. Thus, the percentage in Public Servants and Factory groups in Greece is between 4 and 7 per cent, whereas the percentage discovered in a survey carried out by the British Medical Research Council among similar groups was between 1 and 1.5 per cent. According to a Philadelphia survey, carried out by Elkin, Irwin and Kurzhalz in 1942, of 71,767 civilians working in war factories, the percentage was 2.3. In a survey, conducted by the United States Public Health Service in 1944, of 875,904 individuals belonging to factory groups, the percentage was 1.3.

Likewise, incidence rates among candidates for the Armed Forces of Greece (1.82 per cent) are higher than in the United States, where, for example, Schiller, in a survey of 40,273 applicants for service in the Armed Forces (in Buffalo) discovered an incidence rate of 0.45 per cent.

3) *Extent of the Disease*

Of the total of 1,091 clinically significant cases, 607 (55.6 per cent) were minimal, 416 (38.1 per cent) moderately advanced and 68 (6.3 per cent) far advanced. There were 758 cases requiring treatment (68.5 per cent) and 333 observation (31.5 per cent).

Of the treatment cases 42.48 per cent were minimal, 48.94 per cent moderately advanced and 8.58 per cent far advanced while

of the observation cases, 85.59 per cent were minimal, 13.51 per cent moderately advanced and 0.9 per cent far advanced. In the survey of the Factory groups by the United States Public Health Service, 67.7 per cent were minimal, 26.9 per cent moderately advanced and 5.4 per cent far advanced. Out of 1,091 clinically significant cases, 732 were newly discovered cases (67.1 per cent). Chart III shows the distribution of newly discovered and of known cases according to the extent of the disease and broken down into treatment and observation cases. It must be pointed out that of the newly discovered cases, 45.07 per cent were moderately advanced and 9.06 per cent were far advanced.

4) Contribution to the Epidemiological Survey

The great number of newly discovered cases (67.1 per cent) shows how important is the contribution to public health offered by our survey.

In a large number of clinically significant cases diagnosed as minimal, restoration to health was obtained after a short period of treatment and the patients were able to return to their occupations. This is yet another proof of the great importance of mass radiography in early diagnosis of tuberculosis. Even in advanced countries where notification of disease is compulsory and an efficient public health service is available, a certain number of cases of tuberculosis fail to be registered. Moreover, a great number of

MASS RADIOGRAPHY DISPENSARY ATHENS — RESEARCH 1946

TOTAL OF CASES EXTENT OF THE DISEASE 1091

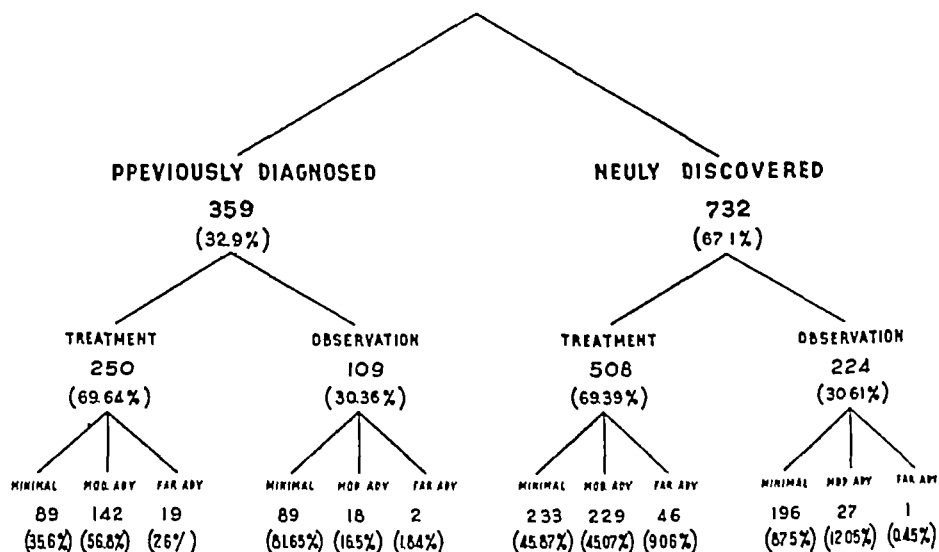


CHART III

suspected early cases can only be reached by mass radiography

Our investigations so far have been carried out among urban groups only and therefore, our conclusions can only apply to the urban population. We hope, however, that by using mobile mass radiography units, we shall very soon be able to extend our survey to the rural areas of Greece.

The tuberculosis incidence in our survey was 3.28 per cent in males, 2.93 per cent in females and 3.21 per cent for both sexes. If our sex composition of our examinees were similar to that of the population (i.e., an equal number of both sexes with a small excess of females), the percentage for both sexes would be reduced to 3.11 per cent. It can be added that similar figures were obtained through surveys carried out in the towns of Salonika and Patras. The average age of our examinees was 29½ years, and therefore lower than the average age of the population. If we estimate the incidence of our examinees aged 29½, based on data obtained for both sexes in this age group (males 2.68 per cent and females 4.05 per cent), and if we adjust the sex ratio to that of the population, we obtain the incidence rate of 3.36 per cent.

It is difficult to determine the average age of our population after the war and the occupation. It was affected before the war by a high infantile and pre-school age mortality. During the occupation, owing to malnutrition and, at a certain period, famine, a great number of individuals in the older age groups died of starvation. At the present time, according to estimates drawn up by the Ministry of Reconstruction, the average age of our population is slightly lower than 40 years. In case the mean age of our group (29½ years) were correspondingly higher (about 40 years), the average incidence rate found (3.21 per cent) would certainly also be higher. Taking all the above into consideration, we think that we have a good foundation for estimating the incidence rate of tuberculosis among the urban population at about 3.5 per cent.

SUMMARY

A mass x-ray examination of 33,971 individuals, belonging to groups of Armed Forces, Educational Institutions, Public Services, Mixed Enterprises, Factories and Special groups gave the following results:

1) Of the total of our examinees, 1091 persons (3.21 per cent) were found to be suffering from clinically significant tuberculosis. The tuberculosis incidence rate in males was 3.28 per cent and in females 2.93 per cent.

2) Of the total of 1091 clinically significant cases, 758 required treatment (68.5 per cent) and 333 observation (31.5 per cent), 607

were minimal (55.6 per cent), 416 moderately advanced (38.1 per cent) and 68 (6.3 per cent) far advanced

Of the treatment cases 42.48 per cent were minimal, 48.94 per cent moderately advanced and 8.58 per cent far advanced, while of the observation cases 85.59 per cent were minimal, 13.51 per cent moderately advanced, and 0.9 per cent far advanced. Out of 1091 clinically significant cases, 732 were newly discovered cases (67.1 per cent)

3) The striking variations in incidence observed among various groups are due to various reasons such as occupation, or lack of it, kind of occupation, difference in age among examinees, previous medical examination, medical follow-up and relief or absence of it among the personnel of enterprises, services and factories, and in some cases to the immediate dismissal of known cases of tuberculosis

4) Comparing our figures with those obtained among similar groups in England and in the United States, it is obvious that higher incidence rates are found among all groups in Greece

5) Differences are observed in the incidence curve of males and females. Thus the incidence curve in males increased with age, whereas in females the highest rates are observed in age groups from 20 to 30. Although the curve of the older age groups shows certain rises in the case of females, it is nevertheless always lower than the curve incidence in males

6) On the basis of the statistical findings of our survey, the incidence rate of tuberculosis among the urban population is estimated to be about 3.5 per cent

RESUMEN

Un examen radiográfico colectivo de 33,971 individuos, pertenecientes a grupos de las Fuerzas Armadas, Instituciones Educativas, Servicios Públicos, Empresas Mixtas, Fábricas y Grupos Especiales, dio los siguientes resultados

1) Del total de las personas examinadas, se descubrió que 1091 (el 3.21 por ciento) sufrían de tuberculosis clínicamente significativa. La frecuencia de la tuberculosis en los hombres fue del 3.28 por ciento y en las mujeres del 2.93 por ciento

2) Del total de 1091 casos clínicamente significativos, 758 requerían tratamiento (el 68.5 por ciento) y 333 observación (el 31.5 por ciento), 607 eran mínimos (el 55.6 por ciento), 416 moderadamente avanzados (el 38.1 por ciento) y 68 (el 6.3 por ciento) muy avanzados

De los casos que requerían tratamiento el 42.48 por ciento eran mínimos, el 48.94 por ciento moderadamente avanzados y el 8.58 por ciento muy avanzados, mientras que de los casos que sólo

necesitaban observación el 85.59 por ciento eran mínimos, el 13.51 por ciento moderadamente avanzados y el 0.9 por ciento muy avanzados. De los 1091 casos clínicamente significativos, 732 fueron casos descubiertos por la primera vez (el 67.1 por ciento).

3) Las conspicuas variaciones en frecuencia observadas entre los varios grupos se deben a varias razones, tales como ocupación, o falta de ocupación, clase de ocupación, diferencias de edad entre los examinados, previos exámenes médicos, investigaciones médicas consecutivas y auxilio o falta de auxilio entre el personal de empresa, servicios y fábricas, y, en algunos casos, a la inmediata despedida de los casos conocidos de tuberculosis.

4) Cuando se comparan nuestros datos con los que se han obtenido entre grupos semejantes en Inglaterra y en los Estados Unidos, es obvio que se encuentra una frecuencia más alta entre todos los grupos de Grecia.

5) Se observan diferencias entre las curvas de frecuencia de hombres y mujeres. La curva de frecuencia en los hombres asciende con la edad, mientras que entre las mujeres las frecuencias más altas se observan en los grupos etarios de 20 a 30. Aunque la curva en los grupos de edades más avanzadas muestra ciertos ascensos en el caso de las mujeres, siempre es más baja, sin embargo, que la curva de frecuencia entre los hombres.

6) Basada en los hallazgos estadísticos de nuestro censo, se calcula que la frecuencia de la tuberculosis entre la población urbana es de un 3.5 por ciento.

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CORRECTION IN THE MAY - JUNE ISSUE

In the article on "Tumors of the Anterior Mediastinum" by Milton S. Lloyd, M.D., F.C.C.P., published in the May-June issue of "Diseases of the Chest" on page 413, credit is given to Merck and Company as contributor of the drug (parachlorophenol). This statement is in error and is hereby corrected to read: "I am indebted to Mallinckrodt Chemical Company, New York City, who contributed a generous supply of the drug."

PRESIDENT'S ADDRESS

Problems Persisting Through the Evolution of Medicine

MAJOR GENERAL SHELLEY U MARIETTA (Retired)*

Washington, D C

There is much of interest and of value in the writings concerning the large field of the history of medicine, and ideas gleaned from such works are helpful in the proper evaluation of modern day procedure. As Winston Churchill once remarked in an address to the Royal College of Physicians, "the longer you can look back the further you can look forward."

Many of the busiest and most progressive practitioners of modern medicine have been so aware of the benefits derived from a study of the evolution of medicine that they have not only been students in that field but have, for the edification of those of us who are less gifted, written extensively on the subject. Osler (1913), McKenzie (1927), Haggard (1933), Castiglioni (1940), and Guthrie (1946) are but a few of the more recent authors to whom we are indebted.

The period of ancient medicine may be considered as beginning with the earliest attempts at healing of which there is any record and ending with the sixth century A D. Primitive medicine in one or another form was in existence many centuries before the earliest records in Egypt, some 5000 B C. Soon after the advent of life on this planet crude attempts must have been employed by heads of families or groups, chieftains, magicians, priests or others supposedly better qualified than the common herd to make decisions and to act. In general it may be said that from 5000 B C to 600 A D the physician had progressed from the status of a medicine man dependent upon dances, masks, incantations and other means of casting out the evil spirits, through the stages of experimentation with various medicaments and procedures, gaining a little knowledge and recording it, separating medicine from magic and religion, to the point of establishing schools, hospitals and libraries, regulating medical practice and especially to more intelligently observe cause and effect. Materia medica and pharmacy were established, if in somewhat elementary form, sanitation was, in Rome at least, understood and practised to a very considerable degree, dissection of the human body was permitted in some countries and anatomy and pathology were taking their essential places in enriching the field of medicine, there was acceptance, at least on the part of the doctor, of the fact that diseases were due to factors other than the action of spirits, the consequence of sin or the wrath of God. Previously many of the faith had felt, as Christian Scientists still do, that reliance upon medical procedure implies a lack of complete faith in religion. Haggard gives credit to Hippocrates for bringing about the reform in the temple cult of healing. His "accomplishment was to relieve the gods of their responsibility for the prevention and the treatment of disease and to place that responsibility where it belonged—squarely upon the shoulders

*Presented at the 14th Annual Meeting, American College of Chest Physicians, June 19, 1948, Chicago, Illinois

of man" Care of the sick at public expense the doctor drawing an annual salary based upon a municipal tax was provided in 200 B C Specialization was already a factor to be reckoned with causing Herodotus to remark about 450 B C that 'the practice of medicine is so divided up amongst them that each physician is a healer of one disease and no more All the country is full of physicians some of the eye some of the teeth some of what pertains to the belly and some of the hidden disease" It will be noted that there is considerable similarity to some of the problems of our days and the solutions are not yet clear

Medieval medicine may be said to have extended from 600 A D to 1600 A D During this period there was a general regression of scientific medicine but the work was carried on with a lessened vigor through three channels The South Italian School, Byzantine Medicine, and Arabian Medicine

The strongest remaining offshoot and greatest factor in the perpetuity of medical science of that time was Arabian medicine Following their conquest of half of the then known world the Arabs seized with appreciation and avidity upon the scientific knowledge of the conquered areas and applied themselves to master this field Their accomplishments were rapid and so complete that in about one century they had surpassed their instructors, the conquered scholars, although they continued a more or less friendly competition with them

In this period must be mentioned Roger Bacon (1214 A D) who was one of the first to indicate the necessity for original research instead of the blind acceptance of some then accepted authority, past or present

During the medieval period of medicine it is apparent that although the accomplishment as to progress was greatly diminished in volume and that there was an actual degradation of medical practice in the greater part of the civilized world there were certain recompenses when the picture as a whole is considered The medicine of Hippocrates and Galen was kept alive and even added to somewhat in southern Italy and in Arabia The Church, although for centuries it had subordinated normal medical procedure to the use of various religious forms or rituals, translated and preserved in its archives a considerable medical literature extant at that time, further by its action in the sixteenth century to accord to lay medicine the freedom and the right to reinstitute its domain in the field of medicine by the use of any and all reasonable means the Church did inestimable service in the advancement of medical progress Rulers lessened restrictions and many avenues previously barred to study were again made available

Also there was a new enthusiasm for learning for a new way of life for progress and thus the stage was set for the Renaissance and for the development of modern medicine which began about the end of the sixteenth century

The tremendous amazing strides made in the past three hundred and fifth to four hundred years and more especially in the past fifty years in medical science and in its practical application to the problems of preserving health and treating disease constitute one of the finest chapters in world history one in which we as members of the medical profession may take just pride

The period of modern medicine is so replete with important accomplishments that any attempt no matter how concise to even mention its features within the limits of this discussion would be futile

Since the time of I-em-hotep an Egyptian who flourished about

4900 B C in the Nile valley and who was the first fairly authentic medical practitioner of note, certain vexatious and recurring problems have annoyed the medical profession. Among the most important of these have been Control by Church or State, absorption of it's function by public services, medical teaching both pre and post graduate, research activities, and specialization.

The experience of the past amply demonstrates that the profession of medicine does not function best under the dominance of either Church or State and especially when the two are synonymous. Recall if you please that the period from 410 A D to 1550 A D, when medicine was disdained and indeed learning as such was discountenanced, was concurrent with the so-called Dark Ages and the dominance of the Christian Church in all fields. Although this subject has been discussed at length in the literature it is perhaps as well not to belabor it but only to draw attention to it's history. Even in these enlightened days we occasionally encounter cases in which religious inclinations of one type or other conflict to some extent with our concept of good medical judgment. The ruling power or State has always regulated medicine rather more than less and on the whole for the good of the majority.

On occasions pernicious measures have been recommended and sometimes placed upon the statutes. Generally such regulations have been discontinued after experience has proved their unsuitability. The Hammurabic Code, carved on a diorite block and set up in Babylon in 2000 B C, consisted of a body of civil and religious laws, many of which related to the medical profession, and was for the purpose of informing the populace of their rights. The medical caste in Babylonia was at this time highly organized with practice regulated in detail, scale of fees laid down and penalties provided for malpractice. Some penalties were severe as for example the loss of the hands in case of death of a patient following treatment for a severe wound or post operative loss of an eye. Certainly the penalties were more severe than present day laws provide but so were those for other offenses, this being characteristic of the times.

Well organized public medical service was set up in the Greek cities as early as the latter part of the sixth century B C. Still earlier, hygiene in Egypt was highly developed and cleanliness of the dwellings, cities and even of person was regulated by law. In Rome, during the first century A D, teachers of medicine were provided at public expense. There were both army and navy surgeons and physicians were appointed to care for the poor. These were well paid from public funds and were distributed in proportion to the population. In some localities they were elected to office for a given period and a certain experience and renown were necessary to gain such an office. It is evident then that some government control of the profession has been existent for at least the past 2500 years and that it is less rigid now than earlier. Rules and regulations seem to have always been for the same purposes and indeed there is a considerable similarity as to the general principles involved.

It is well within the memory of many of us here when the instruction in medical schools was largely didactic. Speakers became red faced in their oratorical efforts to expound to the students what the latter might better have read at another time from text books or journals. Theory versus practice. We find in ancient medicine a similar and long enduring situation, finally settled after centuries in favor of bedside teaching. Hippocrates the great observer and practical bedside teacher, Galen,

bombastic, theoretical who loved words and arguments and who left for the Arabian successors to Greek medicine his methods which they long followed Eventually the Hippocratic principles returned with the Renaissance but the tide has always ebbed and flowed Osler in one of his lectures had this to say "Live in the ward Do not waste the hours of daylight in listening to that which you may read by night But when you have seen, read And when you can, read the original description of the masters who, with crude methods of study, saw so clearly" A French writer said "Formerly we generalized with few facts and many ideas, now we generalize with many facts and few ideas" This remark suggests the picture of a medical neophyte who, with the help of an incomplete history and an inadequate physical examination plus a considerable number of laboratory slips some pertinent to the case at hand and some unessential, sits down to arrive at a diagnosis—many facts and few ideas

The need for investigation which could have at that time been another name for research, was appreciated centuries before Christ In the beginning of medicine everything was necessarily based upon the trial and error method—empiricism—and it was not until about the seventeenth century that more accurate procedure was made possible by improved facilities, both in equipment and method However Pythagoras in the fifth century B C is said to have taught study of causes as a means of gaining knowledge Galen, in the second century A D made experimental studies which led to important discoveries in the physiology of the nervous system Since the seventeenth century there has been a markedly accelerated impetus in this field until it has become one of the largest and most important branches of medicine

Research connotes "a critical and exhaustive investigation or experimentation having for its aim the revision of accepted conclusions, in the light of newly discovered facts" (Websters Dictionary) While it is true that vitally important discoveries have occasionally been made accidentally, generally as an incident in the progress of some perhaps unrelated investigation true research requires a first and perhaps the most important step of deciding what particular problem is to be studied This infers that the choice is made by those thoroughly familiar with the general field of the study and with what other investigators are presently doing in that field As is usually the case with the medical profession the pendulum swings frequently too far, research now seems high on the upswing Many studies are undertaken ill advisedly either because of poor selection, lack of funds to carry through, lack of necessary equipment overlapping or even covering of studies already under way or recently completed or because competent workers in that particular field are not selected Thus funds are dissipated, issues are confused and erroneous results are reported We should also appreciate that compilation of statistics gathering of data or theorizing as to possible implications of certain hypotheses do not constitute research

Of the many branches of medicine probably only embryology and anatomy have been well covered by the studies done heretofore Histology and pathology are well up on the list but possible developments with carbon isotopes and the improved microscope may bring further light into these fields Of the many others but a few will be mentioned Geriatrics should interest several of us here as being included in a rapidly growing section of the population I look with some misgivings into the not distant time when half of the people of the United States

will be in the older age group, fifty or more years. This can not have a wholesome influence on the welfare of the nation, economically, culturally or strategically. Still it is the policy and the ethics of the profession to prolong life to the final gasp and preventive medicine is just getting well into its stride. Perhaps in a few decades thinking will be in terms of euthanasia which is said to have been carried out so practically by the cave dwellers. When old persons became too feeble to climb the pole to the cave entrance they were left to the mercy of the wild beasts, and the others were freed from the burden of their care. There was no expense, only labor was involved at that time and no institutions or hospital beds had to be considered.

Physiology and physiological chemistry may be expected to benefit materially through the use of radioisotopes but these agents, because of the dangers inherent in their makeup, will be available only to individuals and institutions authorized, because of their training and facilities, to properly make use of them. Radiophosphorus in polycythemia vera and leukaemia, radiiodine in thyroid disorders, radiogold in malignancies of the lymphoid system and radiosodium in leukaemia, all have promise.

Synthetic chemical products constitute an intriguing field but here again research is limited to large institutions with extensive facilities and a permanently operating trained group of specialists for consultant and technical purposes. It is quite possible that astonishing new products may be made available to the medical profession later as has been done in the past. In this connection, recognition should be accorded certain of the large pharmaceutical firms which maintain extensive laboratories and labor constantly to produce refined and standardized products for the control or cure of disease. There is an altruistic attitude which is highly commendable, as too much success with new discoveries could adversely affect the sale of some of their earlier products, thus outmoded.

The development of antibiotics has the research group agog. Penicillin has been quite well evaluated. Streptomycin soon will be. We are learning again that no remedy can ever be unequivocally good. Undoubtedly there will be more moulds offered for therapeutic purposes. The newest one of promise is chloromycetin which is particularly effective against some of the virus infections. Here is a sphere in which our own group may well find an opportunity to participate.

What of specialization, just now a subject of wide discussion. Specialists are mentioned in Egyptian medical records. Darius of Persia had specialists at his court about 530 B. C. Herodotus, about 450 B. C., remarked with apparently not full approval as to the number of medical specialists then in being. In the fifth century A. D. Susruta, a prominent physician of India, is quoted by Guthrie as saying of specialists, "He who knows only one branch of his art is like a bird with one wing." The fact that there have been specialists from the time of Egyptian medicine and that their relative proportion in the profession is increasing proves the public sponsorship of the arrangement. Approximately 50 to 60 per cent of the doctors in the United States at the present time are devoting all or a considerable proportion of their practice to some special field.

There are two reasons for this. First, physicians because either of a less arduous life, greater financial returns, supposedly increased prestige or sheer inability to keep abreast of the current in the constantly widening field of medicine, have been and will continue to limit their practice.

to that segment which seems to promise them most. Whether or not this is a desirable situation or whether we approve of it, is beside the point. It exists. Second, patients in seeking the best in medical attention apply logically to some one whom they feel to be especially well qualified to give an opinion or to carry out the particular medical procedure. Equally logically, the choice goes to the doctor who has had more experience in the condition for which treatment is desired, ergo the doctor who limits his practice to this and like diseases, the specialist. All this may seem unnecessarily elementary but it provides simple answers to the frequent and querulous complaints that too many doctors are limiting their practice. So far as I know there are no means of controlling this tendency. The incompetent doctor, specialist or not, may very properly be penalized for malpractice when his performance falls below the commonly accepted standards but he can not be otherwise chastened. The one effective method, as I see it to control the poorly qualified specialist, and at the same time protect the public which experiences considerable difficulty in obtaining reliable information on the matter, is the procedure known as certification. To the long established and well qualified physician in any field, whose renown is a matter of record, certification or lack of it, may mean little. To the newcomer as a specialist certification with all that it implies in the way of professional recognition, listing in the medical associations and ethical publicity, may be the stepping stone to success.

To acquire certification the applicant must meet the requirements set up by competent medical authority and it is evident that the higher the requirements the better the standing both professionally and with the public, of that specialty and the greater the prestige of its membership. I am of the opinion that a competent specialist must have had a good grounding in medicine and must maintain a working knowledge of the parent science. It is equally apparent to me that an internist is not in position to give patients the best in the way of early and accurate diagnosis and treatment in all of the several spheres into which modern medicine has been divided by its practitioners, without consultation with at least some of the specialists in these spheres.

Patients rich as well as poor tend more and more to visit medical schools, hospitals and clinics where they are offered the opportunity of being seen by various specialists and may be given laboratory tests as indicated, by trained technicians under the supervision of specialists, and incidentally at considerably less cost. They, as well as doctors, recognize the advantages inherent in such a system.

With this glimpse into the past of medicine we may the better reconcile ourselves with our present problems and realize that we are considering not entirely new factors but often old ones in a new setting. The latter setting is of our own manufacture and is no more immutable than those of the past. The utmost care, consideration and discretion are required as we modify it, and modify it we must to meet ever new demands.



RICHARD H OVERHOLT, M.D., F.C.C.P

P R E S I D E N T

American College of Chest Physicians

1 9 4 8 - 1 9 4 9

Richard H Overholt M D . F C C P

Installed as College President

Dr Richard H Overholt was installed as President of the American College of Chest Physicians at the Fourteenth Annual Meeting of the College in Chicago, June 17-20, 1948

Dr Overholt was born in Ashland Nebraska He received his A.B degree from the State Teachers College Peru Nebraska and he graduated from the University of Nebraska School of Medicine He served a two-year internship at the University of Pennsylvania Hospital in Philadelphia and during the next three years was a Fellow in Surgery under the late Professor George Muller at the University of Pennsylvania Hospital His interest in thoracic disease was kindled in Pennsylvania while he was working on the services of Dr Chevalier Jackson Dr David A Cooper and Dr George Muller

Following the completion of his postgraduate surgical training in Philadelphia Dr Overholt went to Boston, Massachusetts, to join the Surgical Staff of the Lahey Clinic where he engaged in the practice of general and thoracic surgery for a period of eight years He resigned from the Lahey Clinic to enter the private practice of thoracic surgery and became affiliated with the Tufts College Medical School where he became Clinical Professor of Surgery

His principal hospital connections are the following The Pratt Diagnostic Hospital the New England Hospital and the Cambridge Tuberculosis Sanatorium He is consultant Thoracic Surgeon to the New Hampshire State Sanatorium the Rhode Island State Sanatorium, and four county sanatoria in Massachusetts

FOURTEENTH ANNUAL MEETING

American College of Chest Physicians

The College has concluded another successful meeting. The registration, as indicated below, was the largest on record for a College meeting, exceeding our last annual meeting by 130 physicians. There was a total of 785 physicians registered for the scientific assembly of the College and for the Session on Diseases of the Chest in the Scientific Assembly of the American Medical Association. They came from 43 states, the District of Columbia, Alaska, Hawaii, Puerto Rico, the Virgin Islands, and from 22 other countries. Over 200 physicians' wives and guests also attended the meetings. For the first time in the history of the College, a social program was planned for the ladies under the chairmanship of Mrs. Kenneth G. Bulley, Aurora, Illinois, wife of the President of the Illinois Chapter of the College. These activities were so successful that the officials of the College have agreed to plan similar activities for future meetings. The total attendance of physicians and their wives at the College meeting this year was well over one thousand.

The various committees charged with the arrangements for the annual meeting handled their assignments efficiently and effectively. It was one of the best conducted meetings ever presented by the College and the officials in charge of the arrangements are to be congratulated for this splendid achievement.

Registration

<i>State</i>	<i>Number Registered</i>
Alabama	4
Arizona	14
Arkansas	1
California	40
Colorado	21
Connecticut	4
Delaware	1
District of Columbia	12
Florida	14
Georgia	9
Idaho	1
Illinois	124
Indiana	17
Iowa	5
Kansas	5
Kentucky	12
Louisiana	4
Maine	2
Maryland	9
Massachusetts	16
Michigan	32
Minnesota	23
Mississippi	4
Missouri	34
Montana	1
Nebraska	5
New Jersey	22

<i>State</i>	<i>Number Registered</i>
New Hampshire	1
New Mexico	2
New York	63
North Carolina	10
Ohio	41
Oklahoma	8
Oregon	7
Pennsylvania	38
Rhode Island	3
South Carolina	6
Tennessee	12
Texas	27
Utah	1
Virginia	13
Washington	2
West Virginia	6
Wisconsin	27
TOTAL	703

<i>U S Possessions</i>	<i>Number Registered</i>
Alaska	1
Hawaii	3
Puerto Rico	2
Virgin Islands	1
TOTAL	710

<i>Other Countries</i>	<i>Number Registered</i>
Argentina	8
Australia	4
Brazil	2
Canada	23
Chile	1
China	3
Cuba	5
Ecuador	2
England	1
France	2
Guatemala	2
India	1
Iraq	1
Ireland	1
Korea	1
Mexico	10
New Zealand	1
Pakistan	1
Peru	2
South Africa	1
Spain	2
Venezuela	1
TOTAL	75
GRAND TOTAL	

Dr Charles M Hendricks Receives Second College Award



Dr Charles M Hendricks, El Paso, Texas, Past-President of the College, was presented with the College Medal and Certificate of Award for meritorious achievement in the specialty of diseases of the chest at the annual meeting of the College in Chicago. The Award was made by Dr Edward W Hayes, Monrovia, California, Chairman of the Committee on College Awards, at the Annual Presidents' Banquet held at the Congress Hotel on June 19th.

Examinations for Fellowship

On the first day of the College meeting 52 candidates were given oral and written examinations for Fellowship in the College This is the second largest group to take the examinations

Presidents Banquet

Dr Fred M F Meixner, Peoria Illinois, was the Toastmaster for the Annual Presidents' Banquet and introduced the guests of honor A Certificate of Merit was presented to Major General S U Marietta, the retiring president, in recognition of his valuable services to the College Dr Chevalier L Jackson, Philadelphia, Pennsylvania Chairman of the Council on Pan American Affairs of the College, introduced the guests of honor from all of the other countries, and the banquet closed with the awarding of the College Medal to Dr Charles M Hendricks, El Paso, Texas Preceding the banquet a cocktail party was given by the Illinois Chapter of the College

Scientific Program

An outstanding scientific program was presented in Chicago under the Chairmanship of Dr Richard H Overholt A new feature of the program this year was the presentation of a series of round table luncheon meetings The demand for tickets for these informal luncheon meetings far exceeded the seating capacity of the rooms It has been recommended that the Scientific Program Committee for the next annual meeting of the College plan a similar program of luncheon meetings Members of the College should secure their reservations for these luncheon meetings as far in advance of the meeting as possible The Committee on Arrangements for the Scientific Assembly under the Chairmanship of Dr Paul H Holinger is to be complimented for the excellent manner in which the scientific assembly was conducted

International Luncheon

The Council on International Affairs of the College sponsored a luncheon meeting at which time the officials of the College from the other countries presented reports of College activities in their respective countries and a number of scientific papers were presented on various aspects of chest diseases Dr Chevalier L Jackson, Chairman of the Council on Pan American Affairs presided at this meeting and was assisted by Dr Andrew L Banyai Milwaukee Wisconsin Chairman of the Council on European Affairs, and Dr Harry C Warren San Francisco California Chairman of the Council on Pan Pacific Affairs

Clinics

A series of interesting clinics was presented at various hospitals in Chicago and all of the clinics were well attended The arrangements for these clinics were under the Chairmanship of Dr Abel Froman Chicago Illinois and the transportation arrangements were under the Chairmanship of Dr Johann Bornstein The physicians attending the clinics were provided with transportation from the hotel to the hospitals and return

Luncheon Meetings

Several important luncheon meetings were sponsored by various councils and committees of the College and interesting programs concerned with the activities of these councils and committees were presented by eminent authorities

Conference of College Chapter Officials

The Annual Conference of College Chapter Officials was held at the Congress Hotel, Chicago, at a luncheon meeting on June 17 and Dr Carl C Aven, Atlanta, Georgia, Chairman of the Conference, presided. A program dealing with the activities of College chapters was presented by various members of the Conference. Dr Charles A Thomas, Tucson, Arizona, was elected Chairman of the Conference for the ensuing year and Dr Irving Willner, Newark, New Jersey, was elected Secretary of the Conference.

New College Officers

Dr Richard H Overholt, Brookline, Massachusetts, was inducted into office as President of the College, and the Committee on Nominations presented the following slate of officers who were elected unanimously

Joseph C Placak, M D , Cleveland, Ohio, President-Elect
 Louis Mark, M D , Columbus, Ohio, 1st Vice-President
 Harry C Warren, M.D , San Francisco, Calif , 2nd Vice-President
 Minas Joannides, M D , Chicago, Illinois, Treasurer

R E G E N T S

<i>Regional District</i>		<i>Term Expires</i>
Number 3	Martin H Collier, M.D , Grenloch, New Jersey	1951
Number 7	James H Stygall, M.D , Indianapolis, Indiana	1951
Number 9	Paul A Turner, M D , Louisville, Kentucky	1951
Number 11	Carl H Gellenthien, M D , Valmora, New Mexico	1951
Number 12	Robert B Homan, Jr , M.D , El Paso, Texas	1951
Puerto Rico	Luis A Passalacqua, M D Santurce	1949
Peru	Ovidio Garcia Rosell, M D , Lima	1949
South Africa	David P Marais, M D Cape Town	1949
Venezuela	Jose Ignacio Baldo, M D Caracas	1949

All present Regents in other countries were re-elected

G O V E R N O R S

<i>State</i>		<i>Term Expires</i>
Alabama	William S Aimour, M.D , Birmingham	1951
California	Buford H Wardrip, M D , San Jose	1951
Connecticut	Cole B Gibson, M D , Meriden	1951
Georgia	Carl C Aven, M D , Atlanta	1951
Illinois	Robert K Campbell, M D , Springfield	1951
Louisiana	Alton Ochsner, M D , New Orleans	1951
Massachusetts	Hubert A Boyle, M D , New Bedford	1951
Minnesota	Karl H Pfuetze, M D , Cannon Falls	1951
Mississippi	Robert E Schwartz, M.D , Hattiesburg	1951
Missouri	Alfred Goldman, M.D , St Louis	1951
New Jersey	Irving Willner, M.D , Newark	1951

<i>State</i>		<i>Term Expires</i>
New York	George Foster Herben, M.D., Yonkers	1951
Tennessee	David H. Waterman, M.D., Knoxville	1951
Utah	William R. Rumel, M.D., Salt Lake City	1951
Vermont	Albert G. Mackay, M.D., Burlington	1951
Wyoming	Carleton O. Anton, M.D., Sheridan	1951

Governors in U S Possessions

Alaska	Anibal R. Valle, M.D. Seward	1951
Hawaii	William F. Leslie, M.D., Hilo	1951
Puerto Rico	A. M. Marchand, M.D. Santurce	1949

Governors in Other Countries

Australia		
New South Wales		
Wales	William Cotter Harvey, M.D., Sydney	1949
Peru	Juan A. Werner Ortega, M.D., Lima	1949
Venezuela	Julio Criollo Rivas, M.D., Caracas	1949

All present Governors in other countries were re-elected

Report of the Treasurer

FINANCIAL STATEMENT MAY 31 1948

1 CASH ASSETS

Checking Account, First National Bank of Chicago \$35,211 78

Special Funds

Life Membership Bonds, Series G \$ 1,300 00

Life Membership Checking Account 2 085 00

\$3,385 00

Endowment Fund Bonds \$10 000 00

 Checking Account 603 42 10 603 42

Research Council Checking Account 11,589 43

General Reserve Fund Bonds 10,000 00

Total Special Funds 35,577 85

Total Cash Assets \$70,789 63

2 BUDGET

Budget for year ending December 31 1948 \$61 059 98

Budget for last eight months 1948 \$44,500 00

Checking Account balance 35,211 78

Anticipated deficit \$ 9,288.22

Budget for fiscal year ending December 31, 1949 65,700 00

Increase in budget \$ 4,640 02

3 ANTICIPATED INCOME

from all sources in 1949 \$51,000 00

The increase in the budget for 1949 of \$4,640.02 has become necessary because of the increase in prices of all items. Because of this inevitable increase in expenses and the necessity to meet financial responsibilities, it has been recommended to the Board of Regents of the College that ways and means be found to increase the College income.

Respectfully submitted, Minas Joannides, M.D., F.C.C.P.

Report of the Executive Secretary

Another year has come and gone since we met in Atlantic City and I am happy to report to you that it has been a year of progress.

Perhaps the most outstanding achievement during the past year has been the unanimous vote of the House of Delegates of the American Medical Association to establish a Section on Diseases of the Chest in their Scientific Assembly. While this Section is an integral part of the American Medical Association, yet this important achievement would not have been accomplished without the active support of the College. It now becomes an important duty of every College member to support this newly established Section by registering for the Section at the meetings of the American Medical Association and by attending the scientific sessions.

The establishment of this Section on Diseases of the Chest in the American Medical Association has stimulated the College chapters in urging the establishment of similar sections in their state medical societies. I am also happy to report to you that during the past year a Section on Diseases of the Chest has been established in the Scientific Assembly of the Medical Society of the State of New Jersey and in the Medical Society of the State of New York. The College officials in these states who helped to bring this about are to be congratulated. Movements are now in progress to establish similar sections in some of the other state medical societies and I am certain that the efforts of the College officials in those states will also be crowned with success. However, it is not enough to create these sections in the American Medical Association and in the state medical societies, they must be fully supported by the College membership if they are to serve a useful purpose.

Another outstanding achievement of your College during the past year has been the active program of your Council on Postgraduate Medical Education. The Second Annual Postgraduate Course in Diseases of the Chest was presented in Chicago under the auspices of this Council in September, 1947. Sixty-two physicians from 20 states, the District of Columbia, Canada, China, Cuba, Mexico and Spain were enrolled in this course. The first postgraduate course in diseases of the chest to be presented by the College in cooperation with the Laennec Society of Philadelphia was presented in that city in March of this year. Sixty-three applicants from 17 states, the District of Columbia, Canada and India were enrolled in this course. The registration for these courses had to be restricted because of the limited seating capacity and many more applications for both courses were received than could be accommodated.

The Chairmen and all of the members of the Council who directed these courses gave liberally of their time and efforts. Letters received from the physicians who participated in the postgraduate courses gave much praise to these officials, as well as to the instructors and administrators of the courses.

With this excellent achievement to its record, your Council on Postgraduate Medical Education has planned three additional courses in diseases of the chest to be presented in the fall of this year. A postgraduate course will be given in San Francisco from September 13 through September 17 in collaboration with the University of California Medical School and Stanford University School of Medicine. The Third Annual Postgraduate Course will be given in Chicago from September 20 through September 25 and the first postgraduate course to be given in New York City will be held from November 8 through November 12. Complete information on these postgraduate courses will be mailed to the members of the College as soon as it is available.

The companion to the Council on Postgraduate Medical Education is the Council on Undergraduate Medical Education. Your Council on Undergraduate Medical Education has conducted a constructive and energetic program over a period of years and their activities have culminated in the publication of two essential books for undergraduate medical students. One of these books which is now on the press, is entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications (for the Student, the Teacher and the Practicing Physician)." The other book, now being compiled, will deal with non-tuberculous diseases of the chest. These books are being published by Charles C. Thomas Publishers, Springfield, Illinois. Those members of the College who are engaged in teaching will no doubt want to have the books made available to their undergraduate medical students, and we are certain that all members of the College will want to have copies of these excellent books in their libraries.

Another important part of our medical educational program is the presentation of scientific papers at the various international, national and sectional meetings of the College. To help make this possible, College chapters have been organized in practically every state and district in the United States and its possessions, as well as in many countries outside of the United States. These chapters, which in many cases meet with other organized medical societies, present an excellent forum for discussion of the latest developments in the specialty of diseases of the chest.

All of these College activities which form the basis of our medical educational program, find expression in the official journal of the College, "Diseases of the Chest."

We have added pages to the journal to take care of the accumulation of scientific material. Circulation of the journal is now at its highest peak. We are happy to report that "Diseases of the Chest" is read by physicians in 53 countries. This excellent record is due to the efforts of your Editorial Board under the able direction of its chairman, Dr. Jay Arthur Myers. Today "Diseases of the Chest" is recognized throughout the world as the outstanding publication in this specialty. This is an achievement of which all of the members of the College may be justly proud.

Notices of the College activities during the past year have been given prominence in the various state and county medical society publications, as well as in the Journal of the American Medical Association. Numerous scientific journals in other countries have also carried accounts of College affairs. We are particularly grateful to the fine publicity given to the College activities in the "Revista Panamericana de Medicina y Cirugia del Torax." This journal, under the direction of

our able Regent for Mexico, Dr Donato G Alarcon, publishes the College news concerned with Latin American affairs, in the Spanish language for the benefit of our Spanish-speaking members I would also like to point out that the scientific articles in this journal are published in both Spanish and English

The present College By-Laws were adopted in June, 1942 During the past six years your College has more than doubled in membership and its activities have increased many times It has accordingly become necessary to revise our present By-Laws and a committee to study the revision of the College By-Laws is now diligently engaged with this important task The revised By-Laws will be submitted to the College membership as soon as they are available

The international program of the College deserves special comment in the Report of your Executive Secretary Our membership extends into 48 countries and we are pleased to report that despite the unsettled conditions existing in Europe, your Council on European Affairs has admitted 88 members in the following countries Austria, Belgium, Czechoslovakia, Egypt, England, France, Greece, Hungary, Ireland, Italy, Lebanon, The Netherlands, Norway, Palestine, Portugal, Scotland, Spain, Sweden, Switzerland, Turkey and Yugoslavia

The Council on Pan Pacific Affairs has also shown a marked increase in its membership, particularly in Australia, China and India The most recent College chapter to be organized is the one for South Africa, where we have 21 members As conditions become more stable, College chapters will be organized in many of the other countries

The splendid achievement of our Council on Pan American Affairs is worthy of comment With few exceptions, there are active College chapters in most of the Central and South American countries The large delegations of our good friends from the countries to the north and to the south of the United States who attend our annual meetings, are evidence of the excellent accomplishments of our Council on Pan American Affairs

College members in any part of the world can now travel to 47 other countries and find the welcoming hand of a Fellow of the American College of Chest Physicians Truly, the American College of Chest Physicians is a world society

No report of your Executive Secretary would be complete without an expression of appreciation for the fine cooperation received from your President and all of the other officials of the College To the Assistant Executive Secretary, the College Auditor, and to all of the other members of the College staff, your Executive Secretary expresses his appreciation and thanks Without their loyal support, this report of progress would not be possible

We have come a long way in achieving many of the objectives of the American College of Chest Physicians There is still much to be done Our sights are set and we must not be deterred from reaching our goal By perseverance and by diligently adhering to the principles which have been established for the College, we will continue to make progress

Respectfully Submitted, Murray Kornfeld

Annual Meeting, Board of Governors

The Board of Governors held their annual meeting at the Congress Hotel on June 17. The meeting was called to order at 10 00 a m by Dr Robert K Campbell, Springfield Illinois, Chairman. The meeting was attended by the following Governors and alternates of the College

State

Arizona	Howell Randolph M.D , Phoenix
California	Seymour M Farber, M.D , San Francisco (alternate)
Colorado	Arnold Minnig M.D Denver
Delaware	Gerald Beatty M.D , Wilmington
Florida	M Jay Flipse, M.D , Miami
Georgia	Carl C Aven M.D , Atlanta
Illinois	Robert K. Campbell M.D , Springfield*
Iowa	J Carl Painter M D , Dubuque
Kentucky	T Ashby Woodson, M.D Louisville
Maine	Francis J Welch M.D , Portland
Massachusetts	Hubert A Boyle, M.D , New Bedford
Michigan	Willard B Howes M.D Detroit
Mississippi	Robert E Schwartz, M.D , Hattiesburg
Missouri	W W Buckingham, M.D , Kansas City
New Jersey	Martin H Collier, M.D , Grenloch
New York	George Foster Herben, M.D , Yonkers
Oklahoma	Robert M Shepard M.D , Tulsa
Oregon	James M Odell, M.D , The Dalles
Rhode Island	Frank A Merlino M.D , Providence (alternate)
Texas	Charles J Koerth M.D Kerrville (alternate)
Virginia	E C Harper, M.D , Richmond
West Virginia	George R Maxwell, M.D , Morgantown
Wisconsin	Carl O Schaefer M.D Racine

U S Army Arden Freer M.D , Washington, D C

Veterans

Administration Roy A Wolford M.D , Washington, D C

Canada (Ontario) H I Kinsey M.D Toronto

Argentina Manuel Albertain, M.D Buenos Aires (alternate)

Cuba Gustavo Alderegula M.D , Havana (alternate)

Ecuador Jorge A Higgins, M.D Guayaquil

Venezuela Jose Ignacio Baldo M.D Caracas

*Chairman Board of Governors

Dr Joseph C Placak Cleveland Ohio Chairman of the Board of Regents of the College presented an outline of the procedure for processing of applications for membership in the College. This was followed by a general discussion of the subject.

A resolution was introduced by the Governor of the College for California requesting that the duties of the Governor in the processing of applications for membership in the College be clarified in the College By-Laws. This resolution was adopted and referred to the Board of Regents.

Dr Karl H Pfuetze Cannon Falls Governor of the College for Minnesota was elected by the Board of Governors as their representative on the Committee on Nominations.

Dr Robert K Campbell was re-elected as Chairman of the Board of Governors for the ensuing year.

Annual Meeting, Board of Regents

The Board of Regents of the College convened at the Congress Hotel, Chicago, Thursday, June 17 at 2 00 p m and again on Sunday, June 20 at 5 00 p m Dr Joseph C Placak, Cleveland, Ohio, Chairman of the Board, presided The following Regents, alternates and invited guests attended the meeting

Joseph C Placak, M D , Cleveland, Ohio, *Chairman*
 Donato G Alalcon, M D , Mexico City, Mexico
 Russell S Anderson, M D , Erie, Pennsylvania (invited guest)
 Carl C Aven, M D , Atlanta, Georgia (alternate)
 Andrew L Banyai, M D , Milwaukee, Wisconsin
 Alvan L Barach, M D , New York, N Y (invited guest)
 Otto L Bettag, M D , Pontiac, Illinois (invited guest)
 L J Buis, M D , Richmond, Virginia (alternate)
 Robert K Campbell, M D , Springfield, Illinois
 Frank S Dolley, M D , Los Angeles, California
 Seymour M Farber, M D , San Francisco, California (invited guest)
 Carl H Gellenthien, M D , Valmora, New Mexico
 Edward A Greco, M D , Portland, Maine
 E C Harper, M D , Richmond, Virginia (invited guest)
 Edward W Hayes, M D , Monrovia, California
 Charles M Hendricks, M D , El Paso, Texas
 Joige A Higgins, M D , Guayaquil, Ecuador (alternate)
 Robert B Homan, Jr , M D , El Paso, Texas
 William A Hudson, M D , Detroit, Michigan
 Chevalier L Jackson, M D , Philadelphia, Pennsylvania (invited guest)
 Minas Joannides, M D , Chicago, Illinois
 Charles J Koeith, M D , Kerrville, Texas (invited guest)
 J George Lang, M D , New York, N Y (invited guest)
 Edwin R Levine, M D , Chicago, Illinois (invited guest)
 S U Marietta, M D , Washington, D C
 Louis Mark, M D , Columbus, Ohio
 Donald R McKay, M D , Buffalo New York (alternate)
 Rene G Mendoza, M D , Havana, Cuba (alternate)
 Jay Arthur Myers, M D , Minneapolis, Minnesota
 William E Ogden, M D , Toronto, Canada
 Richard H Overholt, M D , Brookline, Massachusetts
 J Winthrop Peabody, M D , Washington, D C
 Sir Sidney Sewell, Melbourne, Australia
 James H Stygall, M D , Indianapolis, Indiana
 Harold G Trimble, M D , Oakland, California (invited guest)
 Paul A Turner, M D , Louisville Kentucky
 William C Vooisangei, M D , San Francisco, California (invited guest)
 Harry C Wallen, M D , San Francisco, California

Murray Kornfeld, Chicago, Illinois, Executive Secretary

Harriet E Lumm, Chicago, Illinois, Assistant Executive Secretary

Committee on Membership

Dr Roy A Wolford, Chairman of the Committee on Membership of the College presented the following report As of June 1, 1948, there were 2578 members in the College, and 84 applications for membership were pending investigation This shows an increase of 306 new members

admitted into the College during the past year. Of the 2578 members 1860 are Fellows, 139 Associate Fellows, and 579 are Associate Members. In the United States of America and its possessions there are 1886 members, while in countries outside of the United States, our membership totals 692. These are distributed over 47 countries. Since the report submitted last year by the Committee on Membership, members have been admitted from ten additional countries.

Committee on Certification

Dr J. Winthrop Peabody, Chairman of the Committee on Certification, presented a report of the meeting of his committee with the representatives of the American Board of Internal Medicine at San Francisco in April of this year. The question of a certification board for diseases of the chest is now being studied by the American Board of Internal Medicine and the College Committee will submit a report to the Board of Regents upon receipt of further information from the American Board of Internal Medicine.

Editorial Board

Because of the accumulation of manuscripts accepted for publication in the College journal "Diseases of the Chest," the Editorial Board recommended that the journal be published monthly commencing with the January 1949 issue. To help defray the cost of publication, the Editorial Board recommended to the Board of Regents that there be an increase in the annual dues of the College and that the subscription price of the journal also be increased. This resolution was approved by the Board of Regents and was referred to the Executive Council of the College for further study.

Council on Public Relations

Dr William C. Voorsanger, Chairman of the Council, presented a report and that portion of the original report submitted to the Board of Regents at their meeting in Washington, D. C. in November 1947 dealing with publicity and public relations as pertaining to medical journals and medical societies was adopted.

Council of Medical Directors and Superintendents of Tuberculosis Hospitals and Sanatoria

The following preliminary report of the Council was presented by Dr Russell S. Anderson, Chairman.

This Council has now been functioning since approximately 1944. Dr Benjamin L. Brock was its original chairman and resigned during the early spring of 1948 because he was no longer actively engaged in sanatorium practice *per se*. The undersigned has therefore, been functioning as chairman subsequent to that time.

The Council is composed of nine members under whom two committees are active with an additional combined membership of fourteen. One of these committees, of which Dr Allan Hurst, Denver, Colorado is chairman, has been assigned to the problem of devising recommendations in the field of rehabilitation. The other committee, whose chairman is Dr I. D. Bobrowitz, Otisville, New York, is charged with a more complicated task, namely, the drawing up of a code for the standard-

ization of tuberculosis hospitals and sanatoria. These committees, and particularly their chairmen, have to their credit a prodigious amount of work on these respective projects.

Subsequent to the termination of the World War, the Council has sponsored a luncheon meeting during the annual convention of the College. The luncheon groups were planned to afford the hospital superintendent or medical director a forum wherein he can compare notes with his colleagues and air his problems peculiar to hospital management, both from the medical and administrative angles. The luncheon meeting held in Chicago, June 18, 1948, was well attended and the informal discussions were spontaneous and instructive. An additional hour could have been utilized with profit at this meeting.

A business meeting of the Council and its two committees was held Friday evening, June 18th. The following actions were taken by unanimous vote:

- 1) To request the Board of Regents to consider changing the name of the Council, for the sake of brevity, to "The Council of Tuberculosis Hospitals."
- 2) To accept the attached preliminary reports of the Committee on Rehabilitation and the Committee on Tuberculosis Hospital Standards and submit them to the Board of Regents for further instructions. The hope was informally expressed that they might be published at least in summary or in a condensed form.
- 3) That an additional (or third) committee be authorized by the Board of Regents to function under this Council. This new committee will be specifically interested in hospital practices dealing with such matters as personnel, salaries, operation costs, etc., etc. It will be required from time to time to seek data on such items for the information of administrators, hospital boards, and the like.
- 4) That more time be given the open session of the Council at future meetings of the College, an entire session if feasible.

Your chairman shares the opinion held by the members of the Council that the project of setting up minimum standards for sanatoria is a most important and equally exacting one. There is still more work to be done on this assignment before definitive recommendations can be presented to the College. In fact, it will be next to impossible to set up a completed code of standards unless the Committee on Standardization or some special committee can meet at some central point and cover the various items together for a period of several days.

This report was adopted by the Board of Regents.

Committee on College By-Laws

Dr. Charles M. Hendricks, Chairman of the Committee, reported that the revision of the College By-Laws had been completed and that copies of the revised By-Laws will be sent to the members of the Board of Regents through the mails. The Board of Regents will act on the report of the Committee at their semi-annual meeting to be held in Miami Beach, Florida on Saturday, October 23, 1948. Upon approval of the By-Laws by the Board of Regents, the By-Laws will be published in the official journal of the College, "Diseases of the Chest," and acted upon by the members at the next annual meeting of the College to be held in Atlantic City, June 2-5, 1949.

Council on Research

Dr Alvan L Barach, Chairman of the Scientific Section of the Council reported on several projects which were being studied. These projects were referred to special committees for further study.

Committee on the Management and Treatment of Diseases of the Chest

Dr Edwin R Levine, Chairman, presented the report of the committee. It was recommended that the committee be changed to a council and this recommendation was referred to the Committee on College By-Laws. Dr Levine then introduced Dr Harold G Trimble, Chairman of the Committee on Non Surgical Collapse Therapy, who discussed the questionnaire on standardization of treatment being circulated among a selected group of physicians in the United States and other countries. It is the intention of the committee to extend the survey to the College chapters in order to obtain the opinions of a larger group. The information will then be compiled for publication. This report was approved by the Board of Regents.

Committee on Chest Diseases in Penal and Mental Institutions

The report of the activities of this committee was presented by Dr Otto L Bettag, Chairman. The report was well received and a vote of thanks was extended to Dr Bettag for the excellent work of the committee. The report was approved and will be published in a later issue of the journal.

Council on International Affairs

Dr Chevallier L Jackson reported for the Council on Pan American Affairs, Dr Andrew L Banyal for the Council on European Affairs, and Dr Harry C Warren for the Council on Pan Pacific Affairs. The Board of Regents was pleased with the progress being made by each of these councils and a vote of thanks was accorded to each chairman. Complete reports of the activities of the above councils will be published in a later issue of the journal.

Council on Undergraduate Medical Education

Dr Edward W Hayes, Chairman of the Council, reported that the first set of galleyproofs for the book entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications" has been submitted to the authors and the publishers have promised to have the book available for distribution within the next few months.

Dr Andrew L Banyal, Chairman of the Editorial Committee for the book on non-tuberculous diseases of the chest, submitted the following report:

As authorized by the Board of Regents of the College, our committee has proceeded to organize the book on non-tuberculous diseases of the chest which we hope will be a fitting companion to the book now on the press entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications." The following well-known authors have agreed to write on the subjects indicated:

Roland V Christie M.D. London, England. Emphysema.

Louis H Clerf M.D. Philadelphia, Pennsylvania. Benign Tumors.

George M Curtis, M D , Columbus, Ohio Traumatic Diseases of the Lung and Pleura

Seymour M Farber, M.D , San Francisco, California Carcinoma

Louis L Friedman, M D , Birmingham, Alabama Diseases of the Pleura, including Spontaneous Pneumothorax

Alvis E Greer, M D , Houston, Texas Fungus Diseases of the Lung

Charles M Hendricks, M.D , El Paso, Texas Bronchiectasis

Chevalier L Jackson, M D , Philadelphia, Pennsylvania Foreign Bodies in the Lung

Minas Joannides, M D , Chicago, Illinois Diseases of the Diaphragm

Edwin R Levine, M D , Chicago, Illinois Bronchitis and Bronchiolitis

Edgar Mayer, M D , New York, N Y Pneumoconiosis

Herman J Moersch, M.D, and Associate, Rochester, Minnesota Infarction and Embolism

Jay Arthur Myers, M D , Minneapolis, Minnesota Abscess of the Lung

Richard H Overholt, M D , Brookline, Massachusetts Diseases of the Mediastinum

Richard H Overholt, M D , and Associate, Brookline, Massachusetts Cystic Disease of the Lung

George G Ornstein, M D , New York, N Y Pulmonary Function

J Winthrop Peabody, M D , Washington, D C Loeffler's Syndrome

Bret Ratner, M D , New York, N Y Bronchial Asthma in Children

Gumersindo Sayago, M D , Cordoba, Argentina Echinococcus Disease of the Lung

J J Singer, M D , Los Angeles, California Sarcoidosis

Leon Unger, M D , Chicago, Illinois Bronchial Asthma in Adults

Raman Viswanathan, M D , New Delhi, India Tropical Diseases of the Lung

Italo Volini, M D , Chicago, Illinois The Pneumonias

Andrew L Banyai, M D , Milwaukee, Wisconsin Miscellaneous Topics

No effort or time will be spared in making this book as complete and informative as technical limitations permit. Additional plans are being carried out to achieve this goal. We hope to have the manuscripts completed and in the hands of the printer by the end of this year.

Council on Postgraduate Medical Education

Dr J Winthrop Peabody, Chairman of the Council, reports on the postgraduate course held in Chicago in September, 1947 and in Philadelphia, March, 1948. Both of these courses were highly successful and the Council has completed plans for three postgraduate courses to be presented in the fall of this year. A postgraduate course in diseases of the chest will be given in San Francisco in connection with the University of California Medical School, September 13-17, a second course in diseases of the chest will be given in Chicago, September 20-25, and a third postgraduate course in diseases of the chest will be presented in New York City, November 8-12. The report of the Council on Postgraduate Medical Education was approved with thanks.

Conference of College Chapter Officials

Dr Seymour M Farber, Secretary of the Conference, reported that at their meeting held in Chicago on June 17, the Conference adopted a proposition that the Board of Regents find ways and means of financing speakers to chapter and sectional meetings of the College. In view of

the fact that the national organization is operating at a deficit at the present time, it was decided that it would be inadvisable for the College to attempt to finance the traveling expenses of speakers to chapter and sectional meetings at this time. It was recommended that the College revive its Speakers Bureau and obtain the names of such speakers who would be willing to travel to chapter and sectional meetings at their own expense.

Resolutions

A resolution was introduced by the Board of Governors recommending the clarification of the processing of applications for membership in the College. It was voted to refer this matter to the Committee on College By-Laws.

A resolution was introduced recommending that the Board of Regents hold their semi-annual meeting in Miami Beach on October 23, 1948. The Southern Chapter of the College will meet with the Southern Medical Association in Miami, October 24-25. An invitation has been extended by the Cuban Chapter of the College for the College members attending the meetings in Miami to meet with them in Havana, Cuba on October 26. The resolution was approved.

Communications

A letter was presented from the New Jersey Chapter of the College regarding the schedule of fees for pneumothorax refills advocated by the Veterans Administration, and the Veteran's right to a free choice of physicians. This matter was referred to the Executive Council for further study.

Announcement was made in accord with the College By-Laws that the 15th Annual Meeting of the College will be held in Atlantic City, June 2-5, 1949. The American Medical Association will hold its annual meeting in Atlantic City, June 6-10, 1949.

Announcements

Dr. William E. Ogden, Regent of the College for Canada, commented on the growth of the College membership in Canada and in view of the large expanse of the country, he recommended that members in the various Canadian Provinces meet with College chapters in the United States adjacent to their territories rather than organize independent College chapters. This proposal was approved by the Board of Regents of the College.

Dr. Donald R. McKay, alternate for New York State, announced the establishment of a Section on Diseases of the Chest in the Medical Society of the State of New York. Dr. McKay expressed the regrets of Dr. Nelson W. Strohm, Regent of the College for New York State, at not being able to be present at the meeting in Chicago.

New Officers

Dr. Robert B. Homan, El Paso, Texas, was elected by the Board of Regents as a member of the Committee on Nominations.

Dr. James H. Stygall, Indianapolis, Indiana, was elected by the Board of Regents to the Executive Council.

Dr. Paul A. Turner, Louisville, Kentucky, was elected as Chairman of the Board of Regents to succeed Dr. Joseph C. Placak, Cleveland, Ohio.

who is now President-Elect of the College

Dr William A Hudson, Detroit, Michigan, was re-elected as Historian of the College

Section on Diseases of the Chest in A M A Draws Large Audience

The first Session on Diseases of the Chest in the newly established Section on Diseases of the Chest in the Scientific Assembly of the American Medical Association was presented at Navy Pier, Chicago on Thursday, June 24 More than 500 physicians attended the session at which a symposium on streptomycin was presented by leading authorities The papers were well received and the concensus was that this symposium on streptomycin gave to the medical profession the latest information on the use of the drug in the treatment of various chest conditions

Following the reading of the first scientific paper, the Nominating Committee, appointed by Dr Richard H Overholt, Chairman of the Session, comprised of Dr Edward W Hayes, Monrovia, California, Dr Andrew L Banyai, Milwaukee, Wisconsin, and Dr. Joseph C Placak, Cleveland, Ohio, presented the following slate of officers for the Section on Diseases of the Chest

S U Marietta, M.D , Washington, D C , Chairman

Harry C Warren, M D , San Francisco, California, Vice-Chairman

Jay Arthur Myers, M D , Minneapolis, Minnesota, Secretary

J Winthrop Peabody, M.D , Washington, D C , Delegate

Charles M Hendricks, M D , El Paso, Texas, Alternate

The above officers were unanimously elected by the physicians present who were registered in the Section on Diseases of the Chest The House of Delegates and the Council of the American Medical Association are to be congratulated for the establishment of this Section on Diseases of the Chest in the Scientific Assembly

"Diseases of the Chest" to be Published Monthly

The Editorial Board has been unable to publish the large number of timely papers submitted for publication in "Diseases of the Chest" despite the increase in the number of pages in the journal during the past year Because of this situation, the Editorial Board recommended to the Board of Regents of the College that the journal be published monthly instead of bi-monthly The Board of Regents voted favorably on this proposal and commencing with the January, 1949 Issue, "Diseases of the Chest" will become a monthly publication

The increase in the cost of publishing the journal monthly, in addition to the increase in all other College expenses, will result in a deficit of \$25,000 for the year 1949 In order to partially meet this deficit, the Board of Regents has voted to increase the annual dues for Fellows of the College from \$15 00 to \$25 00, and for Associate Fellows and Associate Members from \$15 00 to \$20 00 This increase in dues applies to members residing in the United States of America and is effective January 1, 1949 The subscription price for "Diseases of the Chest" will be advanced from \$5 00 to \$8 50 per year to subscribers in the United States, and from \$6 00 to \$9 50 per year to subscribers in other countries This increase in subscription becomes effective January 1, 1949

Announcement

The scientific papers presented at the 14th Annual Meeting of the College held in Chicago, will be published in future issues of "Diseases of the Chest"

Report of the Historian

Mr President ladies and distinguished guests and Fellows of the American College of Chest Physicians

It is fitting and proper that at this time in our deliberations we pause to pay respect to the memory of our fellow physicians who have completed their earthly duties and have passed to their reward

The example which they gave to us their fellow physicians, shall live forever The seeds which they sowed with such copious hands shall still germinate and bear fruit under the full light of heaven

Their admonition to us is "Finish every day and be done with it You have done what you could Some blunders and absurdities may have crept in, forget them as soon as you can Tomorrow is a new day You shall begin it well and serenely and with too high a spirit to be encumbered with your old nonsense"

"Their moving fingers writ and having written moved on, nor all our pity nor wit shall lure them back to cancel half a line nor all our tears wash out a word of it"

DECEASED MEMBERS

June 1 1947 — June 1, 1948

Max Pinner, M.D Berkeley, California

Editor of the American Review of Tuberculosis

Pierre Ameiulle M.D , Paris, France

George Cambers Anglin, M.D , Toronto, Ontario, Canada

Henry C Drew, M.D Washington, D C

Eugenio Garcia Fernandez M.D , Hato Rey, Puerto Rico

William Gregory Gunn, M.D , Versailles Missouri

Frank T Harper M.D Burlington, North Carolina

Harwood LeRoy Hollis, M.D Lacona, New York

Wilson Pendleton, M.D Asheville North Carolina

Harry Patton Reid, M.D Legion, Texas

Phillip Schonwald, M.D , Seattle, Washington

Bryant R Simpson M.D San Diego, California

Samuel Humes Watson M.D Tucson, Arizona

Walter Hobert Watterson, M.D , LaGrange, Illinois

Leon Gilbert Woodford, M.D , Everett, Washington

* * * * *

William Devitt, M.D Allenwood, Pennsylvania

Our beloved first president 1935-1937, a kindly man whose heart was filled to overflow with sympathy and tender solicitude for all who were afflicted with infirmities His was a keen mind filled with visions of things to come He well foresaw a great future for our College

Time goes on you say? Ah no alas time stays, we go, leaving behind our ever act thought and word to reverberate in the halls of time through all eternity

Respectfully submitted, William A Hudson, M.D F C C P

Convocation

The Third Annual Convocation was held at the time of the 14th Annual Meeting of the College and 129 candidates were admitted to Fellowship in the class of 1948. The Fellowship Certificates were awarded to the new Fellows by Major General S U Marietta, Washington, D C, President of the College. The Convocation address was delivered by Dr J Roscoe Miller, Chicago, Illinois, Dean of Northwestern University Medical School. Dr Miller was introduced by Dr Richard H Overholt, Brookline, Massachusetts, President-Elect of the College.

The following candidates were admitted to Fellowship in the College in the class of 1948, and received their Fellowship Certificates

Osler A Abbott, Atlanta, Georgia
 Alfred Adler, Mt Vernon, Missouri
 Reuben M Anderson, Hackensack, New Jersey
 Albert H Andrews, Chicago, Illinois
 Joseph P Atkins, Wynnwood, Pennsylvania
 Albert H Baker, Calgary, Canada
 Ralph W Ballin, State Sanatorium, Maryland
 William S Barclay, Sardis, Canada
 Solomon S Bauch, Newark, New Jersey
 Lewis F Baum, South Orange, New Jersey
 Mary C Block, Santa Ana, California
 Johann Bornstein, Chicago, Illinois
 Henry J Brock, Buffalo, New York
 Cabot Brown, San Francisco, California
 H H Brueckner, Canton, Ohio
 J Edmond Bryant, Evanston, Illinois
 L James Buis, Richmond, Virginia
 J J Burrascano, New York, New York
 William S Burton, Richmond, Virginia
 Robert O Canada, Washington, D C
 A A Carabelli, Trenton, New Jersey
 Sumner S Cohen, St. Louis Park, Minnesota
 Charles B Craft, Bozeman, Montana
 Eugene J DesAutels, Hines, Illinois
 J Edward Dolan, Perry Point, Maryland
 Thomas E Dredge, Minneapolis, Minnesota
 Isaac Epstein, Alexandria, Louisiana
 David D Feld, Milwaukee, Wisconsin
 John P Fetherston, Milwaukee, Wisconsin
 Y F Fujikawa, Mt Vernon, Missouri
 Andre Gelinas, St Hyacinthe, Canada
 William H Glass, Hartford, Connecticut
 Jacob Goldberg, Castle Point, New York
 Leon Goldberg, New York, New York
 Leon H Gornel, Los Angeles, California
 George H Hames, Saskatoon, Canada
 Irving H Herman, Saskatoon, Canada
 Gerald F Hogan, Amherst, Massachusetts
 Isaac Horowitz, Brooklyn, New York
 Hugh L Houston, Murray, Kentucky
 W Leonard Howard, Northville, Michigan
 George R Howell, Montreal, Canada
 Leroy Hyde, Van Nuys, California
 Linneus G Idstrom, Minneapolis, Minnesota
 Kenneth C Johnston, Chicago, Illinois
 Archibald R Judd, Hamburg, Pennsylvania
 Gordon F Kincade, Vancouver, Canada
 Karl P Klassen, Columbus, Ohio
 William S Klein, Chicago, Illinois
 Alexander Krasnitz, New Lisbon, New Jersey
 Robert C Laird, Toronto, Canada
 Aaron A Landy, Van Nuys, California

S A Levinson, Chicago, Illinois
Anthony D Liroy, Tallhina, Oklahoma
Harold R Lipscomb, Aspinwall, Pennsylvania
Ellert E Lundegaard, Orange, California
Harold A Lyons, Brooklyn, New York
Saul A. Mackler, Chicago, Illinois
Edward H Mandell, Minneapolis, Minnesota
David Marcus, Cleveland, Ohio
Alexander Marshall, Tranquille, Canada
William K Massey, Nelson, Canada
Bernard E McGovern, North Hollywood, California
Clifford C McLean, Kitchener, Canada
Melvyn McQuitty, Ste Anne de Bellevue, Canada
Patrick McShane, New Brunswick, New Jersey
Constantine P Mehas, Pontiac, Michigan
Edwin Mendelsohn, Philadelphia, Pennsylvania
Gerard Michaud, Roberval, Canada
Philip Morgenstern, Black Mountain, North Carolina
Robert B Morrison, Austin, Texas
Solomon Netzer, San Fernando, California
William E Nutzman, Kearney, Nebraska
John A O'Hale, Brecksville, Ohio
Francis H O'Neill, Pittsburgh, Pennsylvania
Forrest M Ostrander, Battle Creek, Michigan
Jean P Paquette, Montreal, Canada
Harry E Peart, Hamilton, Canada
Samuel Phillips, Memphis, Tennessee
Irving Pine, Asheville, North Carolina
Joseph C Placak, Jr, Cleveland, Ohio
Virgil A Plessinger, Cincinnati, Ohio
Sam Poller, Castle Point, New York
Henkel M Price, Martinsville, Virginia
Solomon M Rauchwerger, Oteen, North Carolina
Leo G Rigler, Minneapolis, Minnesota
John J Quinlan, Kentville, Canada
Alfred Ring, Jamaica, New York
James A R Rogers, Patterson, New Jersey
Paul Wolfe Roman, Baltimore, Maryland
George C Roth, St Paul, Minnesota
Wyatt E Roye, Richmond, Virginia
Jack H Rubin, Outremont, Canada
Charles W Rudolph, Tucson, Arizona
Robert E Schell, Swannanoa, North Carolina
Miller H Schuck, Buffalo, New York
John A Seaberg, Minneapolis, Minnesota
Reuben I Shapiro, Detroit, Michigan
David V Sharp, Minneapolis, Minnesota
J Vincent Sherwood, Grand Rapids, Michigan
Maurice M Shoor, Los Angeles, California
Harry Shubin, Philadelphia, Pennsylvania
Alexander C Sinclair, St Vital, Canada
Bertram L Snyder, Phoenix, Arizona
Robert M Sonneborn, Wheeling, West Virginia
Aaron A Sprong, Excelsior Springs, Missouri
Herbert S Stalker, Tranquille, Canada
Reuben E Stone, Washington, D C
J Earle Stuart, Plainfield, New Jersey
Lloyd K Swasey, Phoenix, Arizona
Henry C Sweany, Chicago, Illinois
John T Szypulski, Mt Carmel, Pennsylvania
Henry K Taylor, New York, New York
Joseph F Tedesco, Castle Point, New York
Efton J Thomas, Miami Beach, Florida
Samuel Topperman, Otisville, New York
Kenneth A Tyler, Gooding, Idaho
Robert A Ullman, Buffalo, New York
Joseph L Versage, Stockertown, Pennsylvania

Italo F Volini, Chicago, Illinois
Agnes M Walker, Hamilton, Canada
Starnes E Walker, Kansas City, Missouri
Henry W Walters, Sunmount, New York
Francis J Weber, Washington, D C
Clarence L Wheaton, Chicago, Illinois
Gertrude H Wilber, Great Kills, New York
Francis M Woods, Brookline, Massachusetts
Cuthberg B Young, Tyler, Texas
Julius Zelman, San Bernardino, California

College Chapter News

CALIFORNIA CHAPTER

Cabot Brown, M.D , F C C P , San Francisco, President of the California Chapter of the College, has announced the following committee appointments for the ensuing year

Membership Committee

John C Sharp, M D , Salinas, Chairman
William A Cassidy, M.D , Livermore
Rudolph H Sundberg, M.D , San Diego

Program Committee

Lyman A Brewer, III, M D , Los Angeles, Chairman
Gordon A Diddy, M.D , Ahwahnee
Joseph L Robinson, M.D , Los Angeles

Nominating Committee

Edward W Hayes, M.D , Monrovia, California
Forrest J Bell, M.D , San Francisco
Jacob J Singer, M D , Beverly Hills

Postgraduate and Undergraduate Education Committee

Frank S Dolley, M D , Los Angeles, Chairman
Seymour M Farber, M D , San Francisco
Edward W Hayes, M D , Monrovia
William L Rogers, M D , San Francisco

NEW ENGLAND STATES CHAPTER

The New England States Chapter of the College held its annual meeting on July 10 at the State Sanatorium, Wallum Lake, Rhode Island. The following program was presented

"Diagnostic Bronchial Lavage in Tuberculosis,"
Marcio M Bueno, M.D , F C C P , Fall River, Massachusetts
"Pathological Bronchoscopic and Surgical Aspects of
Endobronchial Tuberculosis,"
Norman Wilson, M.D , Boston, Massachusetts

PENNSYLVANIA CHAPTER

The Pennsylvania Chapter of the College will hold its annual business and scientific meeting in Philadelphia on Monday, October 4. Further details will be sent to the members of the chapter regarding reservations. The annual meeting of the Medical Society of the State of Pennsylvania will be held in Philadelphia, October 4-7.

WISCONSIN CHAPTER

The annual meeting of the Wisconsin Chapter of the College will be held in Milwaukee on Sunday, October 3rd. An interesting scientific program is being planned and will be announced in a later issue of the journal.

TUBERCULOSIS SOCIETY OF ROSARIO, ARGENTINA

The new officers of the Tuberculosis Society of Rosario, Argentina are as follows:

Juan Carlos Barberis, M.D., President
Abraham F. Schottlender, M.D., General Secretary
Jorge Geary, M.D., Acting Secretary
Federico Scharping, M.D., Treasurer
Manuel B. Pardo, M.D., Angel Invaldi, M.D., and
Isaac Alberto Hassan, M.D., Directors

Drs. Schottlender, Pardo and Hassan are members of the American College of Chest Physicians.

College News Notes

Hollis E. Johnson, M.D., F.C.C.P., Nashville, Tennessee, has been appointed by the President of the College as Regent for District No. 9 comprising the states of Alabama, Kentucky, Louisiana, Mississippi and Tennessee, to complete the unexpired term of Paul A. Turner, M.D., F.C.C.P., Louisville, Kentucky, who has been elected as Chairman of the Board of Regents of the College.

On February 1, 1948, Miguel Jimenez, M.D., F.C.C.P., Mexico City, Mexico, was appointed the Director of Tuberculosis for the Republic of Mexico.

Bret Ratner, M.D., F.C.C.P., Clinical Professor of Pediatrics, New York University College of Medicine, was the principal speaker at a dinner meeting of the Philadelphia Allergy Society on February 25 in Philadelphia. His address was entitled "Pseudodoxia Allergica" in which Dr. Ratner called attention to the many false opinions and false practices in allergy today.

William A Hudson, M.D , F C C P , Detroit, Michigan, gave a lecture on "Surgery of Pulmonary Tuberculosis" before the senior class of the University of Arkansas Medical School on April 22 and on the same evening lectured before a group of surgeons of Little Rock (and Pulaska County, Arkansas) on "Diagnostic and Surgical Problems in Thoracic Surgery, Special Attention to Tumors of the Thorax " On April 30, Dr Hudson gave the Frank Vinsonhaler Memorial Lecture before the students, faculty and guests at the University of Arkansas Medical School His subject was "A Historical Review Concerning the Development of Thoracic Surgery "

Manuel Albertal, M.D , F C C P , Buenos Aires, Argentina, a member of the Committee on Chemotherapy and Antibiotics of the College, was invited to address the Cuban Chapter of the College at Havana on July 5, the Venezuelan Chapter on July 7, and the Peruvian Chapter on July 9 Dr Albertal will speak to the members of these College Chapters on the recent developments in the treatment of chest diseases with streptomycin While in the United States, Dr Albertal made an extensive tour of the various hospitals where stieptomycin is being used in the treatment of chest diseases and he carries with him to the Argentine the latest information on this subject He participated in the program of the 14th Annual Meeting of the College held in Chicago, June 17-20 Dr Albertal will return to Buenos Aires on July 10th

BOOKS AND MEDICAL JOURNALS WANTED FOR CHINA

The Council on Pan Pacific Affairs of the College will appreciate receiving old or current medical books and journals for shipment to medical schools in China Please send your books and journals to Dr Harry C Warren, Chairman, Council on Pan Pacific Affairs, American College of Chest Physicians, 384 Post Street, San Francisco, California

FALL POSTGRADUATE COURSES

The American College of Chest Physicians announces the presentation of three postgraduate courses in diseases of the chest being sponsored by the Council on Postgraduate Medical Education of the College The courses will be held in San Francisco, Chicago and New York City Further information regarding these courses and coupon for application may be found on page x in the front advertising section of this issue of the journal

AMERICAN COLLEGE OF PHYSICIANS ANNOUNCES POSTGRADUATE COURSE IN CARDIOLOGY

The American College of Physicians has announced a Postgraduate Course in Cardiology to be held at the National Institute of Cardiology of Mexico, Mexico City, D F, August 2-13, 1948 Registration for the course must be made through the Executive Offices of the American College of Physicians, 4200 Pine Street, Philadelphia 4, Pennsylvania

Book Review

Exercise During Convalescence, by George T. Stafford, Ed. D., Professor of Physical Education, University of Illinois A. S. Barnes and Co., New York, 1947

In recent years there has been an increasing interest in the convalescent phase of disease and a realization that the period during which a patient is returning to maximum physical and mental capability is as much a matter of medical concern as the treatment of the acute phases. During World War II, these studies received added impetus as a result of the acute necessity for restoring patients to peak condition as rapidly as possible. The war time findings have since been found applicable to civilian conditions. However, in many tuberculosis institutions attention is still focussed completely on cavity closure and sputum conversion without serious regard for the individual's rehabilitation and with no concern for his ability to resume reasonably normal existence on leaving the institution.

This brief work serves a valuable purpose in pointing out the need for rehabilitation as an integral part of any therapeutic program. Although the author concerns himself primarily with physical exercise, he states that a complete program "employs physical therapy, occupational therapy, therapeutic exercises and recreational activities, sheltered and curative workshops, and other therapeutic and social services to restore the patient to his highest level of total fitness." It is necessary that the physician, the social service department, physical and occupational therapists, vocational counsellors and others work together within the framework of an integrated program which is individually adapted to each patient's needs. Only when one observes such a coordinated program in operation does one realize that anything less is inadequate treatment. Such rehabilitation must "begin when the diagnosis is made, should continue throughout his sanatorium and into the post sanatorium readjustment period as long as necessary." Concentration on the pulmonary disease while ignoring the individual's total preparedness for post-hospital existence is a dereliction of our duty to the patient, his family, and the community at large.

The bulk of Dr. Stafford's book is devoted to a description of physical exercises suitable for various types of disability. In one short chapter devoted to tuberculosis he describes various exercises that may be used in a graduated fashion by the tuberculous convalescent. The list is necessarily incomplete and does not include some of the familiar ones employed in reconditioning such special cases as the post thoracoplasty patient. However, these will quickly suggest themselves to any one familiar with the fundamentals of physical medicine.

In summary this book is valuable because it emphasizes the need for beginning rehabilitation early and provides a basis for a physical therapy program.

Obituaries



WILLIAM DEVITT

1874 - 1948

Dr William Devitt was born in Philadelphia in 1874, and died at his home at Devitt's Camp, Allenwood, Pennsylvania, on May 20, 1948. Forced to leave school at the age of thirteen, he became a breadwinner in the mills of Manayunk, one of the industrial sections of Philadelphia. He attended Temple University at night and worked his way through Bucknell Academy. He next attended the Medico-Chirurgical College, now the graduate medical school of the University of Pennsylvania and graduated in 1902. He began practicing in Manayunk.

In April, 1912, he established the institution which has since been known as Devitt's Camp, a private tuberculosis sanatorium, at Allen-

wood, Pennsylvania, and gradually built it up into a modern sanatorium. In contrast to the early days when the accommodations were almost primitive, the valuation of the institution is now close to \$400,000.00 and accommodates 105 patients with a resident staff of physicians and nurses. It serves referring physicians and their patients for a 200 mile radius.

Dr. Devitt was a Fellow and first President of the American College of Chest Physicians, having been elected at its founding in 1935. In 1940 he received a Certificate of Merit from The Board of Regents of the College commending him for his work as first President.

He was a member of the Lycoming County Medical Society, Pennsylvania Medical Society, Fellow of the American Medical Association and American College of Physicians, Member of the National Tuberculosis Association, International Tuberculosis Association, Medical Club of Philadelphia, Laennec Society of Philadelphia, American Trudeau Society, and certified by the American Board of Internal Medicine. He was a member and Past President of the Pennsylvania Tuberculosis Society. In 1928, Dr. Devitt received the honorary degree of Doctor of Science at Bucknell University. He was a 33 degree Mason.

Dr. Devitt was widely known in Pennsylvania and throughout the country for his pioneer efforts in the fight against tuberculosis. He was always a source of inspiration to his patients, to his colleagues and to his staff members. His kindness and courage in the face of any difficulty endeared him to all who knew him. The fruits of his work will continue to benefit many through the years to come. As one who was a pupil and later an associate of Dr. Devitt for almost 20 years, I can speak wholeheartedly and sincerely for his hundreds of patients, friends and colleagues.

John S. Packard M.D. F.C.C.P. Allenwood, Pennsylvania

WILSON PENDLETON

1886 - 1948

Dr. Wilson Pendleton was born on February 22, 1886 in Portsmouth, Virginia. He received his degree of Doctor of Medicine from the University of Virginia in the class of 1908. During World War I, Dr. Pendleton served as a Captain in the Medical Corps. Dr. Pendleton practiced medicine in Asheville, North Carolina for many years, specializing in diseases of the chest and latterly in allergy. He was a Fellow and Charter Member of the American College of Chest Physicians.

Dr. Pendleton died suddenly on March 28 of a cerebral hemorrhage.

Merle D. Bonner M.D. Governor for North Carolina

RESEARCH FELLOWSHIPS THE AMERICAN COLLEGE OF PHYSICIANS

The American College of Physicians announces that a limited number of Fellowships in Medicine will be available from July 1, 1949 - June 30, 1950. These Fellowships are designed to provide an opportunity for research training either in the basic medical sciences or in the application of these sciences to clinical investigation. They are for the benefit of physicians who are in the early stages of their preparation for a teaching and investigative career in Internal Medicine. Assurance must be provided that the applicant will be acceptable in the laboratory or clinic of his choice and that he will be provided with the facilities necessary for the proper pursuit of his work.

The stipend will be from \$2,200 to \$3,200.

Application forms will be supplied on request to The American College of Physicians, 4200 Pine Street, Philadelphia 4, Pa., and must be submitted in duplicate not later than November 1, 1948. Announcement of the awards will be made as promptly as is possible.

DOCTOR DUTCHESS SELECTED TO HEAD NEW A.P.M.A. BOARD

Appointment of Dr. Charles E. Dutchess, medical director of Schenley Laboratories, Inc., as chairman of the newly created board of the American Pharmaceutical Manufacturers Association's medical section has been announced by Dr. Theodore Klumpp, association president.

Dr. Dutchess is a member of the Association for the Study of Internal Secretions, the American Society of Tropical Medicine, the Association of Military Surgeons, the Association of Medical Directors, the Pharmaceutical Advertising Club of New York, and is chairman of the public relations committee of the American Association of Industrial Physicians and Surgeons. He is a Fellow of the American Medical Association and the New York Academy of Medicine.

Serving on the board with him are Dr. J. B. Rice, Winthrop-Stearns, Inc.; Dr. Stanton M. Hardy, Lederle Laboratories; Dr. D. K. Kitchen, Bristol Laboratories; Dr. Paul C. Barton, Brewer and Co., Inc.; Dr. R. L. Conklin, Ames Company, Inc.; Dr. George Hazel, Abbott Laboratories; Dr. Irwin C. Winter, G. D. Searle and Co.; Dr. Paul Spickard, Rexall Drug Co.; and Dr. John M. Shaul, Maltbie Chemical Company.

SPECIAL ANNOUNCEMENTS

SEMI-ANNUAL MEETING, BOARD OF REGENTS

The semi-annual meeting of the Board of Regents of the College will be held in Miami Beach, Florida, on Saturday, October 23. A meeting of the Regents and Governors of the College in the Southern States will be held on Sunday morning, October 24.

SOUTHERN CHAPTER MEETING

The Sixth Annual Meeting of the Southern Chapter of the College will be held in Miami, Florida, on October 24 and 25, in connection with the annual meeting of the Southern Medical Association

An interesting scientific program is being prepared for presentation and luncheon and dinner meetings are also being planned for the meeting. The program for the meeting will be published in the next issue of "Diseases of the Chest"

CUBAN CHAPTER MEETING

The Cuban Chapter of the College has invited College members attending the meeting in Miami to attend a special meeting of the Cuban Chapter in Havana on October 26. College members from the United States will appear on the scientific program as well as several members of the Cuban Chapter

College members who plan to attend the meeting in Miami are urged to make arrangements for a few day's visit to Havana in order to attend the meeting planned by the Cuban Chapter, and to enjoy sightseeing in the beautiful capital city of Cuba. Arrangements for the trip may be made through the Executive Offices of the College (see coupon below)

ULAST TO MEET IN MEXICO CITY IN 1949

The Union of Latin American Societies on Tuberculosis (ULAST) will hold its bi-annual Congress in Mexico City, January 24-29, 1949. The American College of Chest Physicians has been invited to participate in this Congress and all College members are cordially invited to attend. The Governors and Regents of the College in all of the Latin American and North American countries who attend the Congress will gather at a breakfast meeting on Tuesday, January 25. Later in the week a scientific program will be presented by College members and various other interesting activities are being planned.

A complete program of the Congress will be published in a later issue of the journal. College members who are interested in attending the Congress may obtain more detailed information by returning the coupon at the bottom of this page to the Executive Offices of the College.

AMERICAN COLLEGE OF CHEST PHYSICIANS

500 North Dearborn Street Chicago 10 Illinois

Gentlemen: I am planning to attend the meeting(s) checked below. Please send me all available information.

Meeting, Cuban Chapter American College of Chest Physicians
Havana, Cuba October 26 1948

Meeting Union of Latin American Societies on Tuberculosis
Mexico City January 24-29 1949

Name

Address

City

State

Medical Service Bureau

POSITIONS AVAILABLE

Junior physician wanted for sanatorium in New England Single or married without children, salary and maintenance, temporary license obtainable For further information please address Box 177A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Medical resident wanted, full maintenance, salary \$300 00 per month 157 bed tuberculosis hospital For further information please address Box 178A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Dietician Full time, capable and willing to take over entire dietary department Salary \$250 00 per month Full maintenance For further information please address Box 179A, American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Ill

Physician wanted, experienced in general medicine sanatorium in Alaska Complete maintenance, one month's vacation transportation paid, \$500-\$700 per month, depending upon training and experience For further information please address Box 180A, American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Illinois

Wanted Assistant physician for tuberculosis sanatorium Salary open Address Medical Superintendent, Stillwater Sanatorium, Dayton 5, Ohio

Position available Resident physician for tuberculosis sanatorium, experience available in all forms of collapse therapy Credit obtainable toward one year's requirement for Board of Internal Medicine Located in resort area country, beautiful surroundings Exceptionally complete maintenance for self and family Within forty miles of two medical universities Salary dependent on experience Must have Michigan license For further information please address Box 181A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10 Illinois

Position open for a chief resident physician and a junior resident physician in an outstanding tuberculosis institution with over 200 bed capacity Salary, including maintenance, commensurate with experience and qualifications For further information please address Box 182A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Resident physician wanted for 500-bed sanatorium Should have at least one year's experience in chest diseases Complete chest service in teaching hospital of medical school Salary depending upon experience, including full family maintenance Waverly Hills Sanatorium, Waverly Hills, Kentucky

Junior staff physician wanted Yearly increase in salary, liberal sick time paid vacation, optional insurance and retirement plan Must qualify for registration in Michigan 840 bed capacity, complete service plus research For further information address Box 183A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Assistant superintendent wanted in tuberculosis hospital in south-east Texas Excellent opportunity For further information please address Box 184A, American College of Chest Physicians 500 N Dearborn St, Chicago 10, Illinois

Physician in Charge 60-bed institution, capable of assuming responsibilities of an active medical and surgical service Salary depending on experience and ability, including maintenance For further information please address Box 185A American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Pathologist wanted, interested in the development of a research program Duties include routine and special laboratory work relating to diseases of the chest Salary commensurate with ability, includes maintenance For further information please address Box 186A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

Resident physician wanted Good salary and maintenance Prefer young man with family For further information please address Box 187A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois

DISEASES *of the* CHEST

VOLUME XIV

SEPTEMBER-OCTOBER 1948

NUMBER 5

Cytologic Studies of Sputum and Bronchial Secretions in Primary Carcinoma of the Lung

SEYMOUR M. FARBER, M.D., F.C.C.P., MORTIMER A. BENIOFF, M.D.,
JOHN K. FROST, M.D., MILTON ROSENTHAL, M.D.
and GERD TOBIAS, M.D.*
San Francisco, California

Since most primary carcinomas of the lung are bronchogenic they tend to exfoliate cells into the bronchial lumen. The normal current of the bronchial secretions acts as a constant natural "curettage" carrying these cells upward in the sputum. It has been demonstrated¹ that neoplastic cells can be recognized in the sputum, after suitable preparation, in over 80 per cent of cases of proved carcinoma of the lung. The diagnostic accuracy can be appreciated when this percentage is contrasted with that achieved with other single procedures. The cytologic study of sputum for neoplastic cells is rapidly being accepted as a valuable aid in the diagnosis of cancer of the lung. The prerequisites to the effective use of this type of study are two: adequate cytologic technics and an extensive knowledge of the cellular components of sputum.

Development of Cytologic Technics

The expectoration of gross particles of malignant growths of the respiratory tract was recorded as early as 1843 by Walshe.² The first report of the finding of malignant cells in the sputum was made by Beale³ in 1860. The cells were found in a case of cancer of the pharynx. Hampeln⁴ in 1887 was the first to report finding malignant cells in the sputum in a case of carcinoma of the lung. He used unstained smears of fresh sputum and considered that the numerous, large, polymorphous cells which were present

*From the University of California Medical Service, San Francisco Hospital and the San Francisco Department of Public Health.

could only have arisen from carcinoma. The diagnosis of carcinoma of the lung was confirmed at necropsy. Other early workers^{5, 6} used unstained smears or smears stained according to simple methods. By use of these procedures, grossly abnormal cells, particularly if they occurred in clusters, could be recognized as malignant on the basis of rough morphologic characteristics. In spite of the fact that it is necessary to study the details of the nucleus and cytoplasm to recognize neoplastic cells which are less bizarre, Hampeln⁷ was able to report in 1918 that cancer cells were detected in the sputum in 13 of 25 cases of cancer of the lung. In 1939 Althayzen⁸ reported from Russia a 70 per cent accuracy in diagnosis by this method.

Later, a number of workers fixed, blocked, and sectioned sputum according to ordinary histological technics. This makes possible observation of finer cytologic detail. Encouraging reports on this method have been published by various South American authors⁹ who have obtained positive results in from 65 to 100 per cent of their series. Other reports¹⁰ on the use of this procedure have been less enthusiastic and disadvantages have been pointed out. The preparation of sections takes much time and care. Cells may be distorted during sectioning. Suspicious portions of the sputum cannot be picked and thus serial sections must be made to insure accuracy. It is therefore understandable why this procedure has not been widely used.

The development of rapid fixation of wet films of sputum made possible more widespread utilization of cytologic diagnosis. Bezancon and de Jong¹¹ (1913), fixed their smears with a 1 per cent solution of chromic acid and stained them with Unna's polychrome blue. They described the nonmalignant cellular elements of sputum in detail and discussed the origin of these elements. The cytology of malignant cells was also discussed by those authors. Ridge and Treadgold¹² (1913) in England, studied the cytology of sputum in smears made by the same technic and noted that the stain was uncertain and that the films did not keep. Nevertheless, a number of other European authors^{13, 14, 15} utilized the Bezancon and de Jong technic and standard books on the examination of sputum described the technique and cytologic characteristics of nonmalignant and malignant elements on the basis of its use.

A few years later Papanicolaou¹⁶ reported that he had developed a simple method of fixing vaginal smears by which good cytologic detail could be retained. In the course of a comprehensive study of human vaginal smears made during the normal menstrual cycle and in various pathologic conditions he found that exfoliated malignant cells from uterine cancer could be recognized. Although his findings were reported in 1928,¹⁷ little interest in the use of

his method was shown until 1943 when the monograph on vaginal smears by Papanicolaou and Traut¹⁸ was published. In 1946 Papanicolaou¹⁹ reported on the application of his method of fixation and staining to the diagnosis of cancer of the lungs, as well as of the uterus, kidneys, bladder, prostate, and stomach. He was able to demonstrate malignant cells in the sputum in 18 of 21 cases in which carcinoma was proved to be present. In 4 other cases malignant cells were found in the sputum and the diagnosis was confirmed clinically or roentgenologically.

Herbut and Clerf used the Papanicolaou technic for the study of secretions obtained at bronchoscopy and in 1946^{20, 21} reported that they had been able to make an accurate diagnosis in 47 (82 per cent) of 57 cases of carcinoma of the lung. Herbut²² cites 15 cases in which a diagnosis was made on secretions obtained bronchoscopically, but in which malignant cells were not found in the sputum. The technic was also used by Woolner and McDonald²³ who found malignant cells in the sputum in 70 cases. They gave excellent descriptions and illustrations of both the malignant and nonmalignant "flora" of the sputum. How many of these cases were proved to be cases of primary carcinoma of the lung was not stated, nor was the total number of cases studied mentioned.

Dudgeon in London was impressed with the excellent cytologic detail in smears of feces fixed in Schaudinn's solution for the study of parasites. In 1924 he applied this method of fixation to smears of human milk²⁴ for cytologic studies in various conditions. In 1927 Dudgeon and Patrick²⁵ reported on the use of this wet-film technic in the study of this films of scrapings from tumors and other tissues. The material was stained with hematoxylin and eosin. According to their report cytologic detail was clearly shown and the nature of the tumor or tissue could be determined with a high degree of accuracy. Eight years later Dudgeon and Wrigley²⁶ reported that they had used this wet-film technic for examination of the sputum for neoplastic cells. In 58 proven or probable cases of bronchogenic carcinoma the sputum had been shown to contain malignant cells in 39 (68 per cent).

Dudgeon and Wrigley's report was followed in 1937 by the report of another excellent cytologic study of the sputum by Gloyne.²⁷ He modified their technic slightly and was able to demonstrate malignant cells as well as the normal cellular flora. Barrett²⁸ (1939), reviewed the work of Dudgeon and Wrigley. Gowar²⁹ also used the Dudgeon technic and in 1943 reported that he had found malignant cells in the sputum in 36 (64 per cent) of 65 cases of carcinoma of the lung.

An outstanding report on the examination of sputum for malignant cells was made by Wandall in 1944.¹ It was based on exper-

ience obtained in the study of sputum from 250 patients with various types of pathologic conditions of the lungs Using the Dudgeon wet-film technic he was able to detect neoplastic cells in the sputum in 84 of 100 cases of what was proved to be carcinoma of the lung Numerous excellent illustrations were included and the cytology of the sputum was thoroughly reviewed Anyone interested in this field should study this work carefully

It appears then that by means of a wet-film technic (Papanicolaou or Dudgeon) cancer cells can be found in the sputum or bronchial secretions in most cases of carcinoma of the lung Early failures to find cells were probably caused by inadequate application of the technic Results of work with wet-films fixed by the Bezancon and de Jong technic were not as satisfactory as those obtained with the newer technics because the staining was uncertain and the films kept poorly

Preparation of the Material

To obtain accurate results in the examination of sputum for malignant cells, they must be demonstrated in their best-preserved state, in the most expedient fashion, and in the highest concentration Fresh sputum should be obtained whenever possible That raised by spontaneous coughing is the most likely to yield positive results In any event, the sputum should be raised from the bronchial passages by deep coughing

After the sample has been obtained, the careful picking of representative portions enhances the chances for successful use of this procedure To facilitate this selection, the material should be placed in a Petri dish or on a watch glass and examined against a black background A magnifying glass may be used to detect small bits of tissue At times it is easier to examine the sputum if it is first gently emulsified with normal saline solution especially when it is very purulent or tenacious Suspicious bits of tissue, blood flecks, and necrotic material are picked and gently smeared over two thirds of a glass slide The smears should be uniform and moderately thin, that is, 1 cell thick, as in ordinary blood smears

As soon as the smear is spread it should be immersed immediately *while still wet* in a fixative solution consisting of equal parts of ether and 95 per cent ethyl alcohol Even a moment's delay may permit the thinnest portions of the smear to dry and hence may cause significant loss of cytologic detail Paper clips should be put on the ends of alternate slides to prevent contact The material may be left to fix for long periods or it may be removed after from 2 to 4 hours, dried, and, if the smeared surface is suitably protected, transported to a laboratory for examination

If the slides are not to be made directly, sputum may be collected in various fixatives. In our experience the ether-alcohol mixture, or 80-95 per cent alcohol gives adequate fixation. If a lower percentage of alcohol is used, distortion of the cells is more likely to occur. After collection in this fashion, the mixture of sputum and fixative is centrifuged, and the lowermost portion of the resultant "button" is spread on a slide with egg albumin. The pattern of cells is often disrupted and single cells prevail, but cellular concentration is increased and mucus and debris are minimal in amount.

When "buttons" are prepared the cells are rounded and not spread out, so that much of the fine detail is lost. Indeed, the appearance of the spread out cells has been a revelation. The difference is sometimes almost as striking as that between bone marrow sections and sternal marrow smears. Many entirely equivocal changes in sections such as incomplete keratinization, are apparent in comparable smears. Small malignant cells, scarcely distinguishable from lymphocytes in sections, show obvious deformities in smears. In addition, sectioning of the "button" is more costly and time consuming, even when the required equipment is available.

Papanicolaou stated that he preferred to collect all sputum in 70 or 95 per cent alcohol. In his laboratory³⁰ a portion of the fixed mucus is spread with a rotary motion between two albumin-coated slides, and is placed in the alcohol-ether mixture for final fixation. Although the advantage of selection of suspicious portions of the sputum is lost, the fixation is excellent and cytologic detail can be seen clearly.

Various other fixatives have been employed with varying degrees of success. Schaudinn's fixative was used by Dudgeon, Wandall, Gowar, Barrett, Gloyne, Bouin's by Mathews,³¹ formalin by Zemannsky,³² and 1 per cent solution of chromic acid by Bezancon and de Jong. Visualization of cytologic detail with these fixatives has not been improved in our hands, over that obtained with ether and alcohol, and in most instances it has been actually less satisfactory. Further, some are more complicated to use, others are less generally available.

The trichrome stain developed by Papanicolaou has been used by us almost exclusively because of its many advantages over the other methods we have used. Other stains have been used by many with good results, for instance, Dudgeon, Wandall, Gowar, Mathews and Gloyne found hematoxylin and eosin to be satisfactory. Some prefer eosin-methylene blue or Shorr stain.

The greatest value of Papanicolaou's stain is probably the transparency of the counterstain obtained by the use of solutions of

high alcohol content This enables one to see more clearly through the mucus and debris, as well as through overlying and crowding cells, which frequently are present in a slide prepared in this way The brilliancy of the colors, and the predictability of the color range aid greatly in identifying and classifying cells The nuclear detail is brought out well and consistently from slide to slide, without necessity for staining control under a microscope

The staining procedure (Papanicolaou modified by Graham*) is as follows The slides are removed from the fixative at any time after one-half hour has elapsed and stained immediately They may be left in as long as two weeks if necessary If only a few slides are to be stained at a time, Coplin jars may be used However, for routine work it is more convenient to use staining dishes and slide carriers which may be transferred from dish to dish rapidly and will hold up to 20 slides They are successively carried through the following solutions as indicated

The slides are then mounted in neutral Canada balsam Total staining time may be as little as 30 minutes

*Graham, Ruth, Vincent Memorial Laboratories, Massachusetts General Hospital, personal communication

70% alcohol (ethyl)	10 dips*
50% alcohol	10 dips
Distilled water	10 dips
Tap water	10 dips
Harris' hematoxylin without acetic acid)	3 minutes
Tap water	10 dips
0.5% hydrochloric acid	5 dips (NO MORE)
Tap water (running)	4 minutes
Lithium carbonate solution (2 cc saturated solution in 200 cc of distilled water)	1 minute
Tap water	10 dips
50% alcohol	10 dips
70% alcohol	10 dips*
80% alcohol	10 dips
95% alcohol	10 dips
Orange G-6	1 minute
95% alcohol	10 dips
95% alcohol	10 dips
Eosin (EA 50)	2 minutes
95% alcohol	10 dips
95% alcohol	10 dips
95% alcohol	10 dips
Absolute alcohol	4 minutes
Xylol	5 minutes*

*At the points indicated slides may be left in the solution longer, if desired for convenience

The thorough examination of every area of an adequate number of slides is essential for effective use of this procedure. Screening under low power (x120) is adequate if higher power (x450, oil immersion) is used when suspicious cells are encountered. A "hit-and-miss" examination or an "over-all" impression does not suffice. A thorough and systematic screening of the whole slide by a competent, specially trained technician using a mechanical stage, is essential. It is desirable that at least 3-5 slides be made from each of 5 daily specimens, and examined, before a report is given. At least 15 minutes per slide is required by our technicians. Suspicious slides require more time.

Secretions obtained at bronchoscopy are smeared and fixed in the same manner as sputum. An effort should be made to obtain material from the suspicious portions of the bronchial tree.

The finding of malignant cells in pleural effusion is of the greatest prognostic, as well as diagnostic, aid in bronchogenic carcinoma. Soon after tapping, the fluid is centrifuged, the fresh button is smeared on a slide, and the preparation is then immediately immersed in ether-alcohol fixative. The slides are stained, mounted, and screened in the same way as slides of sputum. It is also advisable to prepare a "button" for routine blocking and sectioning.

Cytology of Sputum

Before attempting to recognize malignant cells in the sputum and bronchial secretions it is necessary to study the cells which are present in nonmalignant disease. Direct smears were made from normal fresh tissue obtained at surgery or autopsy. An attempt was made to determine the identity of all cells observed. Direct smears from fresh pathologic tissues were then examined and correlated with the histologic picture as seen in sections. Smears of sputum from patients with nonmalignant disease were then studied and a constant search was carried on for bizarre types of cells which might be confused with malignant cells. As a result of these studies the following descriptions are presented.

Nonmalignant Cellular Constituents "Epithelial cells" Epithelial cells are shed constantly from the walls of the respiratory tract.

1) Squamous cells line most of the pharynx and larynx. In sections the basal cells appear small, and crowded and have small dark nuclei. In *smears*, made directly from the surface of laryngeal mucosa and of sputum these cells do not have particularly dark nuclei and they are only slightly smaller than those at intermediate levels. The reason for this difference is not clear. It may be that when nuclei are relatively crowded, they tend to resist decolorization of hematoxylin. The cytoplasm of basal cells covers

an area approximately twice that of the nuclei, i.e., much less relatively than the cytoplasm of more superficial cells. The Papanicolaou stain colors the cytoplasm an "indifferent" blue or green and no structural differentiation is seen. The cytoplasm of cells nearer the surface are flatter and wider and acquire an angular outline. Close to the surface as complete cornification is attained, the nuclei may fade or become pyknotic. Intercellular bridges are occasionally seen in clumps of epithelium in smears. The well differentiated squamous cell is seen as a wide flat, bright orange sheet, folding of the edges demonstrates its thinness. Appearances of maturation and keratinization as seen in smears are described in detail in the section on malignant cornified cells (Fig 1)

2) Columnar cells may be seen individually and spread out, and have oval nuclei measuring as long as 13 micra, or they may be seen in compact groups in which nuclei are as little as 5 micra across. One must be thoroughly familiar with the appearance of columnar cells in order to distinguish them from small malignant cells. Sometimes the cytoplasm of rounded-up columnar cells appears only as a narrow blue rim, or may not be seen at all and it is also scanty in clusters of cells. For this reason the criterion of

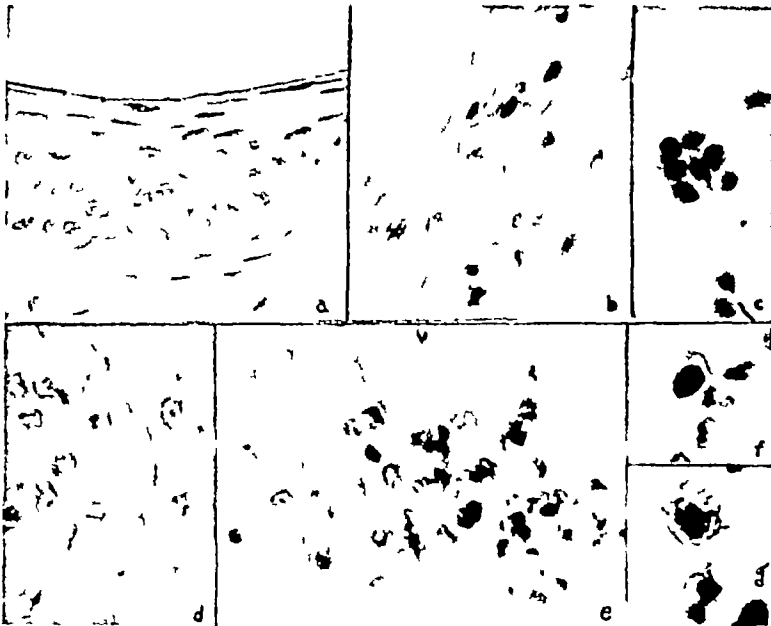


FIGURE 1 Normal squamous epithelium and squamous metaplasia (a) Section of normal laryngeal mucosa X300 (b) Direct smear Superficial squamous cells (c) Direct smear Basal squamous cells The cytoplasm is colored green-blue There is no evidence of keratinization (d) C-47-14 X500 Section of squamous metaplasia Case of lipoid pneumonia Note moderately large nucleus to cytoplasm ratio and moderate irregularity of nuclei (e) S-47-14 Sputum of same case Note variation in size of nuclei as well as in staining intensity (f g) Same case Hyperchromatic nuclei with moderate size in cornified cells The cytoplasm stains orange and is quite refractile

large nucleus to cytoplasm ratio cannot be used for recognition of small malignant cells

The columnar-cell nuclei are only occasionally slightly irregular in shape and the chromatin pattern is delicate. The nucleus may be a hazy grey with indistinguishable granules or there may be a uniform dispersion of minute granules with an infrequent small karyosome and sometimes one or two tiny acidophilic nucleoli. The nuclear membranes are fine, if seen at all. Occasionally the cytoplasm retains its columnar shape with cilia and blepharoplasten at one edge. It is by study of such cells and concomitant ones that the variability of this type is learned. "Goblet cell" nuclei are quite similar. They are located basally and the cytoplasm is moderately distended, globular, and faintly staining (Fig 2)

"Alveolar lining cells" Rather forceful smearing of normal lung tissue will reveal sheets of cells with small moderately granular round nuclei, slightly larger than those of columnar cells, and with wide clear polygonal cytoplasm. In some places such a sheet may give over to a sheet of columnar cells with its much narrower cytoplasm outlines. Cells are found which are morphologically identical to these cells in the sputum, but preserved sheets are rare



FIGURE 2 X500 Columnar epithelial cells (a) Section of normal bronchial mucosa. Many of the nuclei appear hyperchromatic due to overstraining but on smears stained by the Papanicolaou technique overstraining is rare. (b) Sputum. The cells are spread out and the fine granularity and light staining of the oval nuclei is evident. Note blepharoplasten and cilia. (c) Direct smear. Goblet cells. The nuclei are somewhat more irregular than those of columnar cells. (d) S-47-88 Sputum. This group of columnar cells shows the separation and rounding up frequently seen in sputum. (e) Direct smear of normal lung. Sheet of columnar cells viewed "en face". The nuclei appear small and round and the cytoplasm appears scanty. There is a characteristic regularity of pattern, however.

"Histiocytes" and macrophages The term "histiocyte" may be reserved for cells resembling the "resting wandering" cells in areolar connective tissue, in which evidence of phagocytosis cannot be shown When the cells become phagocytic and engulfed debris is present they are called macrophages Histiocytes have small frequently twisted or folded vesicular nuclei and there are rarely pyknotic (5 micra) forms Some do show a moderately coarse granularity, or in some a few coarse granules may be connected to a few threads The cytoplasm is abundant, frequently streamed out and poorly demarcated, and characteristically reticulated or foamy and poorly stained The nuclei of the macrophages usually enlarge and may be quite round, having a prominent membrane and a fairly dense granular chromatin dispersion Several rather large condensations of chromatin may be connected with prominent threads Coherent sheets of cells with large distinct nuclei and abundant sometimes rather dense cytoplasm are commonly seen in alveolar spaces of diseased lung In sputum the diameters of nuclei in many such groups averaged 10 micra and that of the cells ranged around 15 micra The cytoplasm may be denser than that of most histiocytes but is usually foamy or reticulated in some cells and stains light brown Rarely a moderately large hyperchromatic nucleus is seen In cells with this type of nucleus the cytoplasm is still abundant and the nuclear outline is smooth Particularly because of their heavy nuclear membrane, the finding of such cells indicates that special effort should be made in further search, since they resemble some cells of the incompletely cornified epithelium seen in smears from epidermoid carcinoma

The simple small type of histiocytes are not different from epithelioid cells as seen in smears of tuberculous sputum or tissue

The macrophages frequently contain soot As "heart failure" cells, they contain hemosiderin derived from extravasated blood They may be present in many other conditions besides congestive failure such as infarction and lung abscess Cells containing fat are not only found in lipoid pneumonia, but in other inflammatory processes, and presumably the fat is derived from necrotic elements With chronic infections and foreign body reactions (bronchiectasis, tuberculosis, lung abscess) the large multinucleate cells, including the Langhans and foreign body types, often occur Those that we have seen in sputum have small uniform finely granular round nuclei

Blood Cells These enter the sputum by simple extravasation, as well as frank hemorrhage Erythrocytes stain orange to red Occasionally they are distorted by smearing but are easily recognizable The majority of malignant cells in sputum have not been

accompanied by erythrocytes Polymorphonuclear leukocytes are always distinguishable as such A dense clump may give a momentary appearance of an aggregate of hyperchromatic pleomorphic cells but the small size of the nuclei and their multilobularity quickly become obvious Monocytes have small nuclei, the transverse diameters measuring 2 to 3 micra They are indented or kidney shaped and have a fine granularity The cytoplasm is usually foamy and poorly stained Lymphocytes present nuclei which measure about 4 micra in diameter and the cytoplasm is barely seen The nuclei are quite dense, although sometimes uniform coarse granules can be seen Plasma cells contain nuclei of similar size The chromatin granules are larger, more discrete and angular in outline The nuclei are eccentrically placed in an abundant poorly staining cytoplasm

Megakaryocytes are described in sputum by Wandall as normal immigrants from the capillaries He stated that their large nucleus has "berry-shaped" lobulations in an abundant clear pale cytoplasm We have never seen a megakaryocyte in the sputum As seen in smears of bone marrow stained with the Papanicolaou technic, they might be mistaken for malignant cells because the nuclei are hyperchromatic

Malignant Cells in Sputum In order to recognize the appearance of malignant cells either singly or in clusters without the benefit of invasive pattern our first approach was the direct smearing of the surface of fresh tumors These were compared with direct smears from nonmalignant lesions and normal tissues Further, cells which were considered to be malignant in sputum were constantly associated with similar cells in sections of carcinoma from the same patients when available (Fig 3) As has been stated a constant search was made in both sputum and sections from patients with nonmalignant disease for cells which might be difficult to differentiate from cancer cells It is a well known fact that many cells in sections of carcinoma cannot be differentiated from normal epithelial cells This is also true in smears

An attempt was also made to differentiate the types of carcinoma by the characteristics of the cells which were observed This requires a consideration of the classification of neoplasms of the lung Ewing³³ divides them into the following types 1) Bronchogenic carcinoma may be of the squamous cell type or of the cylindrical cell type The latter may have a glandular, papillary, medullary, or mixed pattern 2) Anaplastic carcinoma is usually assumed to have derived from bronchogenic carcinoma, although some separate off part of this group as "oat-cell" carcinoma 3) Alveolar carcinoma is multicentric or diffuse, originating

in the alveoli or at least in the distal portion of the pulmonary tree. These neoplasms show a variable pattern ranging from a glandular one to an indistinctive infiltration. 4) Mucous cell carcinoma shows a uniformly glandular morphologic picture and marked production of mucus. 5) Malignant bronchial adenomas are very rare. Indeed their existence is disputed. They have a peculiarly regular arrangement of uniform small cells into columns, resembling the carcinoids of the intestinal tract. In smears it has frequently been possible to identify epidermoid malignant cells. Rarely an adenocarcinoma or anaplastic type has been recognized. Recognition of the other types of carcinoma listed above has not been feasible. Cells from all the groups may be indistinctive and recognizable only as malignant.

Characteristics by which malignant cells may be recognized are frequently described by general terms, such as "bizarre," pleomorphic or "wild." These are sufficient for some cells and clusters which are so abnormal that no special experience is needed for recognition (Fig. 4). In the majority of instances, however, a more detailed analysis of the morphology of the cells is needed to distinguish them from histiocytes, columnar cells, and incompletely developed or metaplastic squamous cells.

It is our impression that the malignant cells and groups may be classified into distinct types for convenience in reference and

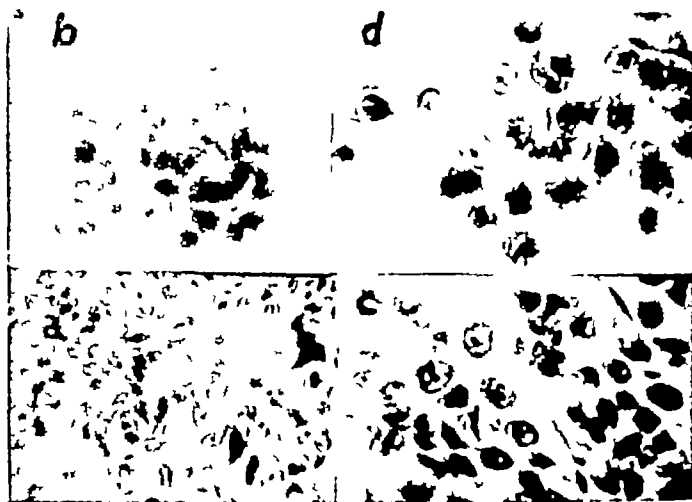


FIGURE 3. Comparable cells in sections and sputum. (a) S-47-47 X300. Section. Epidermoid carcinoma. (b) Sputum, same case. The thick clump, equivalent to a tiny biopsy, shows crowding of nuclei, variation in size, hyperchromatic forms and large nucleoli. Keratinization as evidenced by thick cell membranes, concentric fine lines and orange staining is definite in the smear but not in this field of the section. (c, d) S-47-67 X400. Epidermoid carcinoma, section and sputum smear. No one cell in the smear in this field is patently malignant but the variation in size, large nuclei with scanty cytoplasm, and variation in chromatin are very suggestive. Sufficiently more variation was found in other fields to render a diagnosis reasonably certain.

comparison The following tentative groupings are suggested

Cells with the following characteristics can be reported as "consistent with malignancy"

Large Cells (with nuclei ranging about 15 micra)

Type 1 These are preeminently the cells which allow a positive diagnosis even though they do not necessarily occur in clusters Sometimes it is possible to make the diagnosis after finding two or three cells of this kind However, when one is found more are almost always forthcoming There is dense, almost opaque, hyperchromatism, or moderate hyperchromatism with thick ill-defined, smudged-appearing chromatin condensations, usually in streaks which are eccentric The nuclear membrane, where it does not border on a chromatin condensation, is thick The nucleus is frequently irregular, and particularly may have a jagged contour, with one or more pointed protrusions The irregularity of the nuclei is quite different from the folding and wrinkling of crenulated histiocytic nuclei which appear bended or folded as if by external forces A fold in the periphery of histiocytic nuclei is usually accompanied by one or more streaks or wrinkles as if the nearby portions are yielding to the distortion The nuclei of malignant cells appear to have grown irregularly Warning must be given about one kind of histiocytic cell that is rarely observed



FIGURE 4 Clumps of malignant cells X800 (a) S-47-51 Sputum Unproved Note great variation in size shape and tinctorial density Some of the cells show massive chromatin condensations Lower right nucleus is disproportionately clear A mitosis is seen in the cell to the left (b) S-47-53 Sputum Adenocarcinoma Note the great variation in size markedly irregular "jagged" contours and heavy nuclear membranes In the upper right cell the smudged appearing eccentric massive chromatin condensation is striking

and has been seen in smears of tuberculous tissue. This is apparently a degenerated cell in which the nucleus is moderately large, densely hyperchromatic, and shows angular deformity. These have had a uniformly smudged appearance, no discrete particulate or linear formation being discernible. For this reason, degenerated malignant cells may not be diagnostic.

The malignant cells frequently contain large nucleoli. A huge (over 2 micra) nucleolus alone may be pathognomonic but this is not certain. The cytoplasm may be relatively scant, its area being estimated at about half that of the nucleus. The cytoplasm may be dense, but sometimes is poorly outlined. There are occasional inclusions which usually appear to consist of nuclear debris. Surprisingly, evidence of "cannibalization" is not infrequently observed (Figs 5a and 5b).

Type 2. A second type is usually diagnostic only if an aggregate of cells can be seen, the individual criteria being reinforced by anisonucleosis and variability in staining intensity. These cells do not show the massive chromatin condensations seen in type 1 although there are eccentric irregular clumps. In addition, large cleared areas produce a marked contrast and asymmetry,

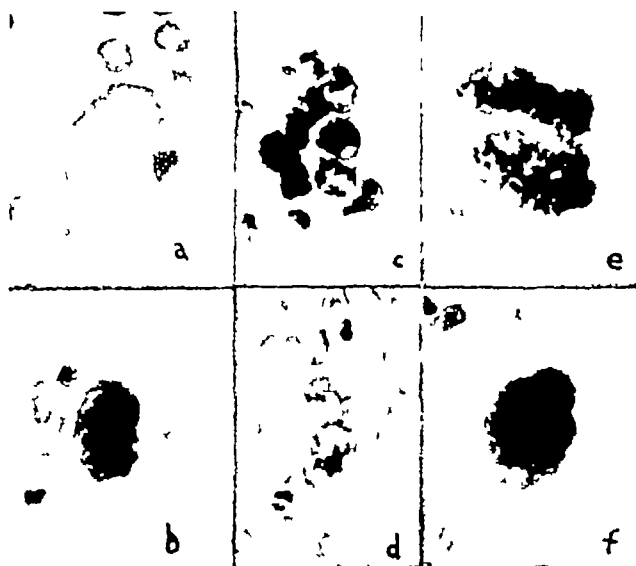


FIGURE 5 X800 Three types of malignant nuclei. Type 1 (a) S-47-53 Sputum Adenocarcinoma. Heavy smudged appearing chromatin condensation in center of nuclei. Note also huge size and irregularity. (b) S-47-1 Sputum Epidermoid carcinoma. Heavy chromatin blocks with general hyperchromatism and heavy nuclear membrane. Note also sharp corners along nuclear contour—Type 2 (c) S-47-53 Sputum Adenocarcinoma. Upper nucleus and low middle nucleus show abnormal clearing, with chromatin condensations along edges. (d) D-17-155 Direct smear Bronchogenic carcinoma. "Moth-eaten" appearance of nucleus due to spotty clearing. No hyperchromatism. There is abundant cytoplasm as is true of many malignant cells—Type 3 (e) D-47-155 Direct smear Bronchogenic carcinoma. Uniform distribution of coarse, unequal, irregular chromatin granules. (f) B-47-117 Bronchoscopic smear Anaplastic carcinoma.

in contradistinction to vesicular nonmalignant cells. The contrast between cleared areas and condensations may give a "moth eaten" appearance. The combination of type 2 nuclei with one or two other criteria such as heterogeneity, great size, large nucleus to cytoplasm ratio, is the most frequent diagnostic finding (Figs 5c and 5d).

Type 3 Cells with even distribution of chromatin, but with very heavy irregular granules, varying in size and shape. These granules are sharply defined and jagged in outline, not to be confused with large but smooth condensations rarely seen in degenerated nonmalignant cells. A direct smear from one bronchial adenoma showed uniform moderate-sized cells and nuclei, but the nuclei showed frequent large chromatin granules (Figs 5e and 5f).

Type 4 Malignant squamous cells. If there is definite keratinization in the cells, certain modifications in the criteria of malignancy may be made. Differentiation of these cells is indicated by several appearances. The cytoplasm may be angular in outline, as in well-cornified cells, or it may be round with a hard, dense border. The cell membrane appears thickened, a double membrane sometimes is seen, the outer layer being a fine line. The increase in density may be indicated by the increased refractility, diffraction lines being easily elicited, or the periphery of the cell, for a wide zone, may become dense and hyaline, forming a ringlike structure. The bright orange color and tiny granular particles are characteristic but not necessarily pronounced. In the rather well-differentiated cells, fine concentric lines are frequently seen in the cytoplasm. The nuclei often have a crumpled contour, caused by small wrinkles and indentations different from the gross bending and folding over of histiocyte nuclei. The term "vesicular" is commonly applied to the usual configuration of a few large granules, sparsely scattered fine granules, and there is usually a large nucleolus. The uncornified epithelial cell, known by its frequent association with the others, is round and smooth in contour, has a green staining cytoplasm, and a moderate-sized round nucleus, usually with a distinct nuclear membrane. This cell cannot be distinguished from some histiocytes, but if it is large and has the usual chromatin aberrations its malignant nature can be detected. Sometimes a diagnostic clump of cells with large oval nuclei which are quite uniform is found. In these there is very little cytoplasm and the appearance is almost that of a clump of large nuclei. The nuclear membranes are thick and nucleoli are prominent but the chromatin granules are fine and the nucleus may be called vesicular. The nuclei are too large and crowded to be either histiocytic or metaplastic. Similar cells are frequently seen in sections of carcinoma (Figs 3 and 6). In

the study of such groups it is extremely useful to have an eyepiece micrometer. It has several times been our experience that a "feeling" that a group of cells was malignant was essentially based on their size, the other abnormalities present not being sufficient for smaller cells. It is awkward to estimate size by visual memory and the actual estimate is surprisingly influenced by hyperchromatism, scanty cytoplasm, etc.

One type of malignant cornified cell is a giant form, the diameter of the nucleus measuring over 20 micra, and the cell over 30. These usually have large chromatin granules or other abnormalities. More frequently a sheet or thick clump of cornified cells may be found. It is not necessary for these to include individual cells which are patently malignant, but the large nuclear-cytoplasmic ratio, occasional hyperchromatic forms, coarse granularity, and the general variation differentiates them from those of metaplasia. As in tissue sections the cells in thick clumps appear smaller because they are not spread out. Their nature is indicated by occasionally discerned keratinization, the crumpled contour of the nuclei, and the large nucleoli, all of which are best seen in

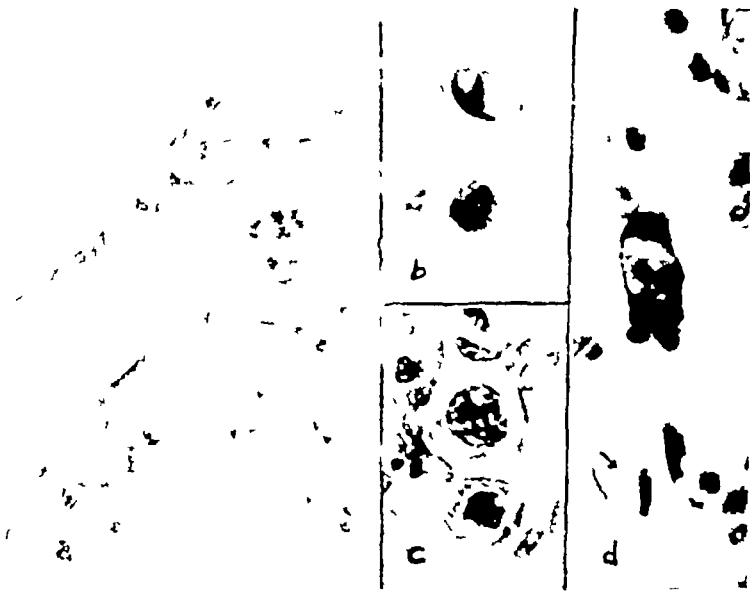


FIGURE 6 Malignant squamous cells X600 (a) S-47-97 Sputum Epidermoid carcinoma. These cells are huge, the one on the right measuring 36 micra, the nucleus 20. The thick cell membrane is especially prominent. (b) S-47-47 Sputum Epidermoid carcinoma. (c) B-47-29 Bronchoscopic smear Epidermoid carcinoma. The cells in 'b' and 'c' are not diagnostic. The relatively large nuclear size is suggestive. The dense thick cell membranes (colored orange) are characteristic of abnormal squamous cells. The "frosted-glass" appearance of the nuclei in 'b' is common in squamous cell nuclei. (d) B-47-1 Bronchoscopic smear Epidermoid carcinoma. The large size and elliptical shape of the nucleus of the cell in the center is probably not consistent with benign lesions. The thick orange cell membrane is not well seen in the picture. The lower two spindle shaped cornified cells with elongated nuclei have not been found except in association with carcinoma.

the marginal cells. It should be noted that a thick clump of any kind of cells will stain orange. Frequently tiny densely orange cornified cells with pyknotic nuclei are seen in sputa in cases of epidermoid carcinoma. They may be only slightly larger than leukocytes. These are usually associated with larger diagnostic cells. When seen by themselves, without nuclear aberrations, they are not diagnostic of malignancy because they are also present in metaplasia.

Small Cells (diameter of nuclei 5 to 10 micra) The criteria of malignancy, as in the large cells, are hyperchromatism, anisonucleosis, irregularity of shape, with frequent protrusions, large irregular and variably sized chromatin granules. The difference from the normal variation of columnar cells or small histiocytes may be extreme, or problematic. Unless an aggregate or many cells with the characteristics mentioned are found, a definite diagnosis of malignancy should not be made. Eccentric condensations, and cleared areas are not common in small malignant cells (Fig 7).

The following factors must also be discounted: 1) High nucleus—cytoplasm ratio—this is common with columnar cells, and the latter can also give a crowded appearance in an aggregate. 2) A limited amount of variation in columnar cell nuclei, both in size and in density of chromatin granules is normal.

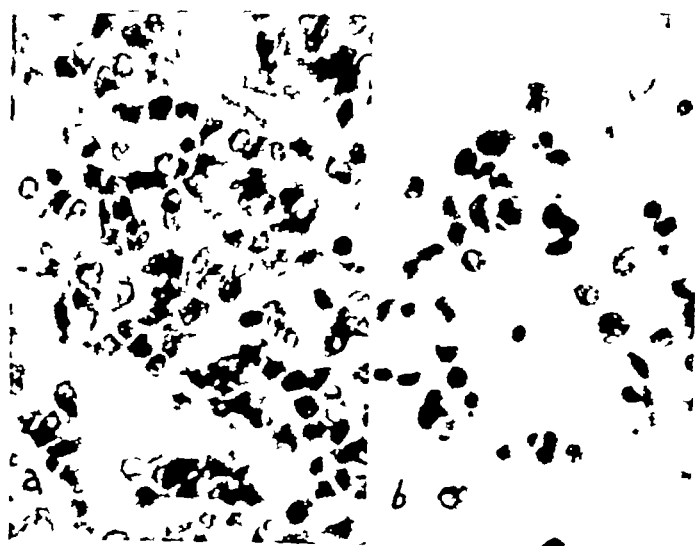


FIGURE 7 Small malignant cells X500 (a) C-47-86 Section of tumor Epidermoid carcinoma. There were many fields such as this with small anaplastic cells. Note hyperchromatism, irregularity and variation in size. (b) S-47-86 Sputum. Many such cells with tiny nuclei quite similar to the cells in the section were found. In addition there were large keratinized malignant cells not shown here. Any kind of carcinoma may show anaplastic cells in the sputum.

Suspicious Cells Cells which have some malignant characteristics, but not sufficient to be called "consistent with malignancy," are referred to as "suspicious for malignancy." The suspicious cells fall into two categories: 1) Those which have not been seen before in proved cases and 2) those which are not sufficiently abnormal to warrant confident exclusion of bizarre nonmalignant cells. Some of these cases seen during the earlier stages of the study would now be reclassified as "consistent with malignancy" because of increased experience. In 11 of the 12 proved cases so reported, the pathologic examination showed that these indeed came from carcinomas. The one exception occurred early in the series, when large abnormal histiocytes were seen in the sputum from a patient subsequently proved to have a lung abscess without neoplasm. With our present experience their identity is familiar and their description is mentioned in the section on histiocytes.

Coherent aggregates of cells with some keratinization, but not

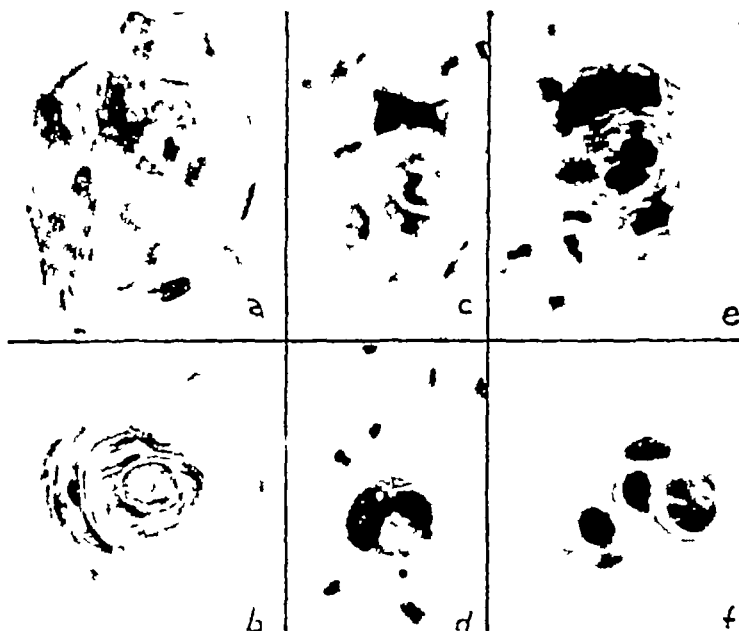


FIGURE 8 (a) S-47-138 X500 Sputum Probable diagnosis of congenital cystic disease of lungs Epithelial cell nest keratin debris including faded and pyknotic nuclei, are surrounded by mature appearing squamous cells with abundant keratinized cytoplasm and tiny pyknotic or faded nuclei (b) S-48-47 Undiagnosed Mature appearing squamous cells surrounding a refractile corneous mass (c) S-47-60 Epidermoid carcinoma direct smear Cornified central cell surrounded by partly keratinized cells with immature appearing nuclei, the topmost one showing irregularity and hyperchromatism (d) B-47-1 Epidermoid carcinoma, bronchoscopic smear "Cannibalization" of one keratinized cell by another, the latter with a large, immature appearing nucleus (e) S-47-97 Sputum Epidermoid carcinoma Refractile well cornified cell surrounded by cornified cell with large irregular hyperchromatic nucleus (f) S-47-49 Sputum Epidermoid carcinoma Central keratin debris surrounded by squamous cells, the inner two showing keratinization (orange color), the outer staining green Although the nuclei are not very large the ratio of nuclei to cytoplasm is high for this degree of cornification

much nuclear variability, comprise the most frequent group to which the term "suspicious cells" is applied. Single partly cornified cells with large nuclei and a small degree of hyperchromatism and irregular condensation are also very suggestive. Metaplasia of the bronchial mucosa is common but it is difficult to know which groups of cells in the sputum correspond to those seen in sections. In the latter, a mild degree of variation in the size of nuclei, and in tinctorial density, is frequently seen (Fig 1). When this variability exceeds a certain degree in tissue sections, *carcinoma in situ* is diagnosed. There is certainly a borderline area in which opinions conflict. The problem here is quite analogous to that with such groups in sputum smears.

Sometimes a pearl-like formation is seen, keratin granules or a keratinized cell being included in a circular formation of two or more epidermoid cells. Whether this is pathognomonic of carcinoma is not certain. It frequently is seen in the sputum in cases of carcinoma in which considerable shedding occurs. In these groups the cells which surround the keratin mass contain dark immature appearing nuclei stretched into an elliptical shape. These formations must be differentiated from epithelial cell nests in which quite mature corneous cells with tiny laked or pyknotic nuclei surround a keratin plug or mass of keratin and cellular debris. The latter are occasionally shed from non-neoplastic lesions (Fig 8).

We have attempted to preserve a forceful connotation with the diagnosis of "suspicious," since in a practical way, such a finding may be at least as valuable as any one suggestive clinical or x-ray sign, and may influence the decision for thoracotomy, bronchoscopy having been negative.

Atypical Cells We have used this term for all unidentified cells, especially in order to encourage the submittal of more material. The nature of many of these cells has been subsequently learned. Single cells with only mild aberrations, and sheets which could as well be histiocytes as poorly differentiated squamous cells are also included.

The following outline of malignant criteria can be used as a key. The value of each criterion and the combinations in which they occur together are of course not shown.

General Criteria for Malignancy

A Aggregate of cells

- 1) Variation in size, shape and density of nuclei
- 2) "Crowding" of cells

B Individual cells

- 1) Cell

- a) Large to huge
- b) Large nucleus with scanty cytoplasm
- 2) Nucleus
 - a) Irregular jagged contour, especially with sharp protrusions
 - b) Aberrations of chromatin
 - 1) Irregular asymmetrical condensations
 - a) Dense with "smudged" appearance
 - b) Sharp with large cleared areas
 - c) Heavy nuclear membrane
- 3) Huge nucleoli, varying in shape and number

Criteria for Particular Types of Carcinoma

- 1) Squamous cell carcinoma
 - a) Giant cornified cells
 - b) Aggregates of partly cornified cells with large nuclei and variation in size and density
 - c) "Pearls" (suspicious)
- 2) Small cell carcinoma—many small dense irregular jagged unequal nuclei
- 3) Adenocarcinoma—many hugely vacuolated cells (with some aberration of nuclei)

Results

In 18 months, 1755 specimens from 500 patients suspected of having "carcinoma of the lung" were submitted to us for cytologic examination. Cells which were reported "consistent with malignancy" or "suspicious for malignancy" were found in 82 cases (Table 1). Pathologic confirmation (biopsy, surgical specimen, necropsy) of the diagnosis of carcinoma of the lung was established in 71 of the 500 cases. Fifty seven (80 per cent) of these 71 cases were reported as being "consistent with" or "suspicious for malignancy." Sputum smears were examined in 66 of the 71 cases in which carcinoma has been proven to be present, malignant or suspicious cells were found in 54 (82 per cent) (Table 2).

Of the proved cases of carcinoma, bronchoscopic smears were submitted from 28, and the cytologic diagnosis of malignancy or suspected malignancy was made in 22. Malignant cells were found in the sputum in all cases but one in which they were found in secretions obtained at bronchoscopy when both were examined. However, in two cases in which the cells in the sputum suggested malignancy, they were not found in the material obtained at bronchoscopy (Table 3).

In most instances, when neoplastic cells were found they were observed in the first sputum specimen examined. As many as 9

specimens from a single patient have been examined before malignant cells were discovered

In no case in which cells were reported as "consistent with malignancy" and in which pathologic examination was obtained, did the sections fail to reveal carcinoma. In one case which was reported "suspicious for malignancy" the patient later underwent pneumonectomy and a lung abscess was found. Several areas of metaplasia and many abnormal macrophages were present, but no malignant lesion was demonstrable.

In 6 of the 16 proved cases in which a negative cytologic report was submitted, the number of specimens examined was not adequate (1 in 2 cases, 2 in 4 cases).

Comment

There are inherent difficulties in the diagnosis of carcinoma of the lung. Of these, the most important is the paucity of symptoms and signs during the early stages. Yet, even when symptoms and findings are present which suggest the nature of the process, the clinician may still be left in doubt by the standard diagnostic procedures. Cytologic studies are of value in many of these instances to establish or confirm the diagnosis.

Since most carcinomas of the lung arise in the major bronchi, a considerable period may elapse before they indicate their presence on an x-ray film as a mass, or by producing obstruction with atelectasis or emphysema. During this time they usually metastasize to the regional lymph nodes. Yet before they produce a shadow on an x-ray they may be exfoliating malignant cells. If the tumor develops peripherally, an x-ray shadow is produced but its nature may not be evident. In such instances, the presence of malignant cells in the sputum would be of great value in diagnosis.

Although most carcinomas arise in the major bronchi a positive bronchoscopic biopsy may be obtained in as few as 41 per cent of cases.³⁴ Distortion and fixation of the trachea or bronchus, or both, may indicate the nature of the process in additional cases, but in the *early* stages all bronchoscopic *findings* may be negative in from 30 to 40 per cent of cases.^{34 35} It is hoped that the presence of carcinoma may be detected earlier by sputum studies, and that more cases may be brought to prompt thoracotomy.

Exploratory thoracotomy has been advocated by some surgeons in cases in which there is a question of carcinoma. However, at the time of thoracotomy, the findings may be equivocal. In such cases preoperative demonstration of malignant cells in the sputum have proved of value. It is possible that as knowledge of the cytologic elements in the sputum is increased the necessity for

TABLE I CASES IN WHICH CYTOLOGIC REPORT WAS POSITIVE OR SUSPICIOUS

CASE NO	S P U T U M* S M E A R S C S A N	BRONCHIAL* S M E A R S C S A N	Bronchoscopic FINDINGS			SPUTUMA			Bronchial* SMEARS			Pleural* Fluid C	R E M A R K S
			Pos	Neg	Def †	No of 1st Spec CorS	No of 1st Spec CorS	No of 1st Spec CorS	No of 1st Spec CorS	No of 1st Spec CorS	No of 1st Spec CorS		
1	47-1	+	+	+	+	11	2	1	1				
2	3	+				2	1	1	1	+		+	Positive Necropsy
3	5	+	+	+	+	1	1	1	1				
4	24	+			+	1	1						Positive Thoracotomy
5	29	+	+	+	+	5	1	3	2				
6	47	+	+	+	+	5	1						
7	49	+	•	+	+	10	1	1					Positive Thoracotomy
8	51	+			+	22	5	1					
9	53	+				14	1						Positive Necropsy
10	56	+				8	1						
11	60	+	2		2nd 1st	5	2	2	1				
12	63	+	+	+	+	3	1						
13	67	+			+	3	1						Positive Lymph Node
14	77	+			+	7	6						
15	84	+				1	1						Positive Thoracotomy
16	86	+	+	+	+	1	1	1	1				
17	88	+				3	1	1					
18	90	+			+	2	1						
19	91	+				2	1						Positive Necropsy
20	97	+	+			5	1	1	1				Positive Biopsy Metastasis
21	99		+	+	+	1	1						
22	106	+		+	+	10	1						
23	108	+			+	7	4	1				+	
24	111	+			+	5	2						Pos Lymph Node (Secondary)
25	117	+	+			1	1	1	1				Positive Necropsy
26	118	+	+	+	+	3	3	1	1				
27	123	+	+	+	+			1	1				

28	127	+	+	5	1	1	Lung Abscess, Pneumonecctomy
29	121	+	+	5	1	1	
30	131	+	+	7	1		Positive Lymph Node
31	144	+	+	6	4		Positive Lymph Node
32	145	+	+	1	1		Positive Thoracotomy
33	140	+	+	4	1	1	
34	140	+	+	11	3	1	
35	155	+	+	3	2	1	
36	159	+	+	4	1	1	
37	100	+	+	1	1	3	
38	171	+	+	7	1		+
39	175	+	+	4	3		Positive Metastasis
40	179	+	+	4	1		Positive Lymph Node
41	186	+	+	6	1	1	
42	193	+	+	2	1		
43	191	+	+	4	1	1	
44	198	+	+	1	1	1	
45	48-5	+	+	1	1	1	
46	21	+	+	2	1	1	
47	28	+	+	2	1	1	Positive Necropsy
48	32	+	+	5	2		
49	39	+	+	2	1		
50	43	+	+	4	1		Positive Lymph Node
51	48	+	+	4	1	1	Positive Surgical Biopsy
52	51	+	+	2	2	1	
53	59	+	+			1	Positive Thoracotomy
54	65	+	+	11	8	1	
55	67	+	+	1	1		
56	70	+	+	3	1		
57	82	+	+	2	1	1	Negative Daniels Procedure
58	95	+	+	7	5	1	Positive Thoracotomy
59	105	+	+	4	1	1	Positive Necropsy
		+	+				Positive Pneumonecctomy

TABLE 1—CONTINUED

CASE NO	S P U T U M*		BRONCHIAL* S M E A R S		Bronchoscopic FINDINGS			SPUTUM*		Bronchial* S M E A R S		Pleural* Fluid		R E M A R K S
	C	S	A	N	Pos	Neg	Def †	No of Spec	CorS	No of 1st Spec	CorS	C	G	
60	109	+						1	1					
61	112	+						4	1					
62	116	+						3	1	1				
63	137	+			+		+	1	1					
64	139	+						1	1					
65	47-23	+						19	9					Positive Lymph Node
66	48-30	+						6	3					
67	119	+						4	2			+		Positive Autopsy
68	146	+						4	1					
69	155													
70	188	+						3	2				+	
71	208	+					+	1	1					
72	210	+						2	2	1	1			
73	215	+						5	1					
74	219	+						1	1					
75	233		+		+		+	2	2	1	1			
76	238	+						2	2					Positive Lymph Node
77	244	+						1	1					Positive Lymph Node
78	250	+						2	1					Positive Lymph Node
79	288						+							
80	295	+								1	1			
81	296	+								1	1			
82	297	+								2	2			

KEY TO TABLES

- C=Consistent with malignancy
 S=Suspicious for malignancy
 A=Atypical cells present
 N=No malignant cells present

† Def =Deformity of the tracheo-bronchial tree

▲ No of Spec =Total number of specimens (of 3-5 slides each) received from patient
 1st C or S=Number of specimens

required to be examined before the first Consistent or Suspicious cells were found
 ▲ Ep=Epidermoid Carcinoma
 Ad=Adenocarcinoma
 Un=Undifferentiated Carcinoma

diagnostic surgical procedures, with their inherent risk and expense, may be reduced. Perhaps in time positive results of cytologic examination will be considered an indication for the use of radical surgical procedures.

It has been advocated that only bronchoscopically obtained secretions should be used for cytologic examination.^{20, 21} In the 23 cases in which both sputum and bronchoscopic secretions were examined, it is noted that sputum revealed malignant cells in 78 per cent of cases as compared to 70 per cent for bronchial secretions. The implication of the fact that sputum can be collected and prepared for cytologic study by any physician is significant, the potential extensive use is obvious. Bronchoscopy as yet is available only in certain medical centers. In addition, repeated sputum studies may be obtained with no discomfort and little expense to the patient. However, bronchoscopy is essential in all cases in which a suspicion of bronchogenic carcinoma exists. More patients will undergo bronchoscopic examination if this suspicion can be aroused by the finding of atypical or malignant cells in routine examination of sputum on all patients over 40 years of age who have thoracic disease. If a patient has an unexplained *nonproductive* cough, bronchoscopic aspiration of bronchial secretions and irrigations may be necessary in order to obtain material for cytologic examination.

Cytologic diagnosis is being accepted by an increasing number of pathologists and clinicians. Its limitations and exact field of usefulness remain to be established as further experience in this field is recorded. The diagnostic significance of some cells has yet to be determined and with further study the identification of the cytologic elements will become more precise. As expected the percentage of accurate positive results increased as experience was acquired and criteria were more clearly established.

The present trend of popularization of cytologic diagnosis of cancer carries certain inherent dangers. It must be emphasized that considerable experience is necessary before malignant cells can be distinguished from certain nonmalignant cells. This cannot be acquired by the occasional examination of smears from the various exudates of the body. It is hoped that these observations will be of use to individuals interested in attaining the requisite experience.

Summary

A simple practical method which has proved useful in suggesting establishing or confirming the diagnosis of carcinoma of the lung has been described. Criteria for the cytologic diagnosis of malignancy are discussed. In our series and in those of other

TABLE 2
PROVED CASES FROM WHICH CYTOLOGIC SPECIMENS HAVE BEEN RECEIVED

CASE NO	S P U T U M* S M E A R S			Bronchoscopic* S M E A R S			Broncho- scopy			Bronchoscopic FINDINGS			OTHER METHODS OF ESTABLISHING DIAGNOSIS			TYPE OF Carcinoma			Sputum* No of 1st Spec CorS			Bronchial Smears		
	C S A N			C S A N			Done			Pos Neg Def +						Ep Ad Un			Spec CorS			Spec CorS		
1	47-1	+					+			+			Necropsy			+			11	2	1	1	1	1
2	3	+						+								+			2	1				
3	5	+						+		+						+			1	1	1	1	1	1
5	24	+						+		+			Surgical Specimen			+			1	1				
6	29	+						+		+			Surgical Specimen			+			5	1	3	2		
7	43							+		+			Surgical Specimen			+			9					
8	47	+						+		+						+			5	1				
9	48							+					Surgical Specimen			+			5					
10	49	+						+		+			Surgical Specimen			+			10	1	1			
11	53	+						+					Necropsy			+			14	1				
12	60	+						+		+						+			5	1	2	1		
13	67	+						+		+			Lymph Node Biopsy			+			3	1				
14	77	+						+		+			Surgical Specimen			+			7	6				
15	84	+											Surgical Specimen			+			1	1				
16	86	+						+		+			Surgical Specimen			+			1	1	1	1		
17	90							+					Necropsy			+			2	1				
18	91	+						+					Necropsy			+			2	1				
19	97	+						+					Skin Biopsy			+			5	1	1	1		
20	99							+		+						+								
21	100							+		+			Surgical Specimen			+								
22	106	+						+		+						+			10	1				
23	117	+						+		+						+			1	1	1	1		
24	123							+		+			Necropsy			+								
								+								+			1	1	1	1		

25	131	+	+	+	+	+	Surgical Specimen	+	+	5	1	1	1
26	134	+					Lymph Node Biopsy	+		7	1		
27	144	+					Lymph Node Biopsy	+		6	4		
28	145	+					Surgical Specimen		+	1	1		
29	146	+					Surgical Specimen	+		4	1	1	1
30	147	+					Surgical Specimen	+		1			
31	155	+	+				Surgical Specimen	+		3	2	1	1
32	179	+					Surgical Specimen	+		4	1		
33	180	+					Lymph Node Biopsy	+		6	1	1	
34	190	+						+		5			
35	193	+						+		2	1		
36	101	+						+		4	1	1	1
37	198	+					Bone Biopsy	+		1	1		
38	199	+					Necropsy		+	1			
39	48-4		+				Surgical Specimen	+		1		1	
40	21	+					Necropsy	+		2	1	1	1
41	30	+						+		2	1		
42	43	+						+		4	1		
43	48	+					Lymph Node Biopsy	+		4	1	1	
44	59		+				Surgical Specimen	+					
45	82	+					Surgical Specimen	+		2	1	1	1
46	95	+					Surgical Specimen	+		7	5	1	1
47	105	+					Necropsy	+		4	1	1	1
48	137	+					Surgical Specimen	+		1	1		
49	47-4						Pos Broncho Biopsy		+	3		1	
50	23	+					Lymph Node Biopsy	+		12	9		
51	31		+				Autopsy		+	2			
52	00		+				Surgical Specimen		+	7		1	
53	102		+				Pos Thorocotomy			4			
54	141	+					Thorocentesis Button			4	1		
55	159	+					Pos Broncho Biopsy	+		5	1		

TABLE 2 — CONTINUED

CASE NO	S P U T U M* S M E A R S				Bronchoscopic* S M E A R S			Broncho- scopy Done	Bronchoscopic FINDINGS			OTHER METHODS OF ESTABLISHING DIAGNOSIS		TYPE OF Carcinoma		Sputum▲ No of 1st Spec CorS		Bronchial▲ Smears No of 1st Spec CorS		
	C	S	A	N	C	S	A		N	Pos	Neg	Def †	Ep	Ad	Un	Spec	CorS	Spec	CorS	
56 175	+				+				+			Metastasis			+		4	3		
57 48-32	+				+				+						+		5	2		
58 65	+				+			+	+			Pneumonectomy			+		11	8	1	
59 70	+				+			+	+			Proven EpId		+			3	1		
60 83				+								(Thoracotomy) Lymph Node BIoopsy			+		5			
61 109	+											Surgical Specimen					1	1		
62 112	+				+			+	+					+			4	1	1	1
63 116	+				+			+	+			Surgical Specimen		+			1	1		
64 119	+											Autopsy			+		4	1		
65 139	+											Autopsy		+			1	1		
66 147				+	+			+	+			Pneumonectomy		+			2		1	
67 169				+				+				Pneumonectomy		+			6		1	
68 233				+	+			+	+		+			+			2		1	1
69 238	+							+	+		+	Surgical Specimen Lymph Node BIoopsy		+			2	1		
70 239				+				+	+		+	Pneumonectomy		+			1		1	
71 244	+											Lymph Node BIoopsy					1	1		
72 250	+				+			+	+			Lymph Node BIoopsy		+			2	1		

KEY TO TABLES

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S=Suspicious for malignancy
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N=No malignant cells present

† Def=Deformity of the tracheo-bronchial tree
▲ No of Spec=Total number of specimens (of 3-5 slides each) received from patient
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▲ Ep=Epidermoid Carcinoma
Ad=Adenocarcinoma
Un=Undifferentiated Carcinoma

workers malignant cells have been detected in the sputum of about 80 per cent of patients proved to have carcinoma of the lung

In a series of 1755 specimens from 500 patients, malignant cells have been demonstrated in 82 cases. Of these 82 cases, 57 have been proved to have carcinoma of the lung by tissue section. In the total series of 500 patients, 71 have been proved to have bronchogenic carcinoma, and in 57 (80 per cent) of these cases, malignant cells were demonstrated.

There is a close correlation of the results obtained by using either sputum or bronchial secretions. The use of sputum is more practical.

The cytologic examination of sputum is a valuable addition to the procedures for the diagnosis of carcinoma of the lung.

RESUMEN

Se ha descrito un método sencillo y práctico que ha demostrado ser útil en indicar, establecer o confirmar el diagnóstico de carcinoma del pulmón. Se discuten los criterios para el diagnóstico citológico de la malignidad. En nuestra serie y en las de otros investigadores se han descubierto células malignas en el esputo de aproximadamente el 80 por ciento de enfermos en los que se comprobó la existencia de carcinoma del pulmón.

En una serie de 1,755 especímenes, obtenidos en 500 enfermos se han demostrado células malignas en 82 casos. De estos 82 casos, en 57 se ha comprobado la existencia de carcinoma del pulmón mediante el examen microscópico del tejido. De la serie total de 500 enfermos, en 71 se ha comprobado que tenían carcinoma broncogénico y en 57 (80 por ciento) de estos casos se demostraron células malignas.

Existe una correlación íntima entre los resultados que se obtienen cuando se usa o el esputo o las secreciones bronquiales. Es más práctico el empleo del esputo.

El examen citológico del esputo es un adjunto valioso a los procedimientos para el diagnóstico del carcinoma del pulmón.

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TABLE 3
PROVED CASES FROM WHICH SMEARS WERE OBTAINED AT BRONCHOSCOPY

CASE NO	BRONCHOSCOPIC* S M E A R S			S P U T U M* S M E A R S			Bronchoscopy FINDINGS			OTHER METHOD OF ESTABLISHING DIAGNOSIS	TYPE OF CARCINOMA		
	C	S	A	C	S	A	Pos	Neg	Def		Ep	Ad	Un
1	+			+			+		+		+		
2	+			+			+		+	Surgical Specimen	+		
3	+			+			+		+	Surgical Specimen	+		
4			+			+			+	Surgical Specimen			+
5	+			+			+		+		+		
6	+			+			+		+	Surgical Specimen	+		
7		+		+						Skin Biopsy	+		
8	+						+		+				+
9			+				+		+	Surgical Specimen	+		
10	+			+						Autopsy			+
11	+						+		+				+
12	+			+			+		+	Surgical Specimen		+	
13	+			+			+		+	Surgical Specimen		+	

14	155	+	+	+	+	+	Surgical Specimen	+
15	194	+	+	+	+	+		+
16	48-4		+	+			Surgical Specimen	+
17	21	+	+	+	+	+	Necropsy	+
18	48		+	+	+	+	Surgical Specimen	+
19	50	+		+	+	+	Surgical Specimen	+
20	82	+	+	+	+	+	Surgical Specimen	+
21	95	+	+	+	+	+	Necropsy	+
22	105	+	+	+	+	+	Surgical Specimen	+
23	47-4		+	+	+	+		+
24	00	+	+	+			Surgical Specimen	+
25	18-112	+	+	+	+	+		+
26	147	+		+	+	+	Pneumonectomy	+
27	233	+		+	+	+		+
28	239	+	+	+	+	+	Pneumonectomy	+

KEY TO TABLES

C=Consistent with malignancy
 S=Suspicious for malignancy
 A=Atypical cells present
 N=No malignant cells present

† Def=Deformity of the tracheo-bronchial tree
 ▲ No of Spec=Total number of specimens (of 3-5 slides each) received from patient
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required to be examined before the first Consistent or Suspicious cells were found
 ♦ Ep=Epidermoid Carcinoma
 Ad=Adenocarcinoma
 Un=Undifferentiated Carcinoma

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Streptomycin and Tuberculosis

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This paper presents a study of 50 cases of pulmonary tuberculosis observed in private practice and in the hospital and indicates that streptomycin has a definite effect on tuberculous disease during this short period of observation.

The effect of streptomycin is seen principally in the clinical aspects and is manifested by a diminution and in some cases disappearance of the specific symptoms, improvement of general condition, gain in weight which in some cases represents more than 10 per cent of the original weight, in the reversal of cutaneous allergy to tuberculin (negative reaction to tuberculin test), and finally the disappearance of tubercle bacilli from the sputum.

As for the radiological aspect of the lesions, we have observed some improvement of certain chronic lesions which were more or less early with some exudative elements. The clearing of early exudative and the predominantly hematogenous lesions is remarkable since it has been observed not only in recent and acute lesions but also in more chronic cases.

The selection of cases for this study was not based entirely on the indications for the use of streptomycin but was partially governed by the ability of the patient to obtain this drug and the demands of the patient's relatives for its use. This circumstance has extended this study beyond the accepted indications as set by the medical authorities of the United States and England.

This fact is important since it permitted us to note a series of favorable effects of streptomycin in acute, subacute, or chronic pulmonary tuberculosis not only in its pulmonary aspect but also as to the extrapulmonary complications that are sometimes associated with it. This will be mentioned later when we describe our results.

We have in this study observed the effect of this drug on pulmonary tuberculosis complicated by diabetes in which streptomycin treatment was associated with the use of insulin in

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adequate doses and the necessary diet to keep the patient sugar-free. In such cases the efficacy of the drug did not decrease. On the contrary, in one case it had extraordinarily good results with almost complete disappearance of the lesion on x-ray examination and sputum conversion.

Another interesting aspect of this study is the application of streptomycin in cases of pulmonary tuberculosis and pregnancy. One patient, 2 months pregnant, suffering from acute exudative pulmonary tuberculosis, was placed on streptomycin therapy. The tolerance to the drug was good, the clinical and roentgenological results satisfactory, and the pregnancy, now 7 months, has continued normally. In another case of tuberculosis and pregnancy the results are even more satisfactory. This was also a case of acute exudative tuberculosis treated with streptomycin in the 4th month of pregnancy. The delivery was normal with normal puerperium, and there were no significant findings either in the mother or the child.

As far as age is concerned, there is no real contraindication on this basis alone. Adolescents, patients of middle age, and even elderly individuals (one with diabetes) have tolerated streptomycin with satisfactory results. It is true that no definite conclusion can be drawn, however, we are justified in judging the effect of streptomycin in relation to the individual's age and the type of disease.

The cases observed and the information secured include both sexes. There were no complications during the menstrual period, but patients suffering from long periods of amenorrhea due to tuberculosis were found to have return of the menstrual cycle.

Our findings in the treatment of extrapulmonary tuberculosis with streptomycin may be summarized as follows:

- 1) Healing of anal fistulae and fistulae due to suppurative adenopathy even after 5 years. In 3 cases there was simultaneous improvement of the general condition and disappearance of toxemia.

- 2) Healing of tuberculous ulceration of the tongue associated with chronic pulmonary tuberculosis. With streptomycin therapy the pulmonary condition and the patient's general condition improved.

- 3) The disappearance of Isambert's syndrome (acute miliary tuberculosis of the larynx and pharynx) associated with hematogenous tuberculosis. There was improvement in the patient's general condition with partial resolution of the pulmonary lesion as seen in the x-ray film.

- 4) Healing of laryngeal tuberculosis of the ulcerative type in a case of chronic hematogenous tuberculosis. This was also ac-

accompanied by general improvement and diminution of the x-ray shadows or their complete disappearance

5) Clinical and functional improvement in some cases in which the x-ray findings persisted or partially disappeared and clinical improvement with disappearance of x-ray shadows in others. Cases of intestinal tuberculosis associated with tertiary tuberculosis, minimal pulmonary tuberculosis, or hematogenous tuberculosis showed improvement

6) Improvement in one case and disappearance in another of symptoms of tracheobronchial lesions associated with subacute pulmonary tuberculosis

Besides the facts already stated we might mention that in the use of the drug recommendations of the Control Committee of the Veterans Administration and the U S Navy for the use of streptomycin were followed in almost all cases, using 1 gram daily sub-divided into 5 doses without treatment during the night

Those toxic effects of the drug which occurred were reversible, and there were no serious complications. In some cases the dose proved insufficient, and since the condition remained stationary, the dosage was increased to 2 grams daily. The 1 gram dose is important since we believe that good results can be obtained with this dosage which is not only economical but also prevents toxic reactions of the irreversible type

Toxic reactions to streptomycin in order of frequency is as follows: Dizziness, when changing from recumbent position, sensation of simple vertigo in some cases and vertigo with hyperacusis in others, frontal and occipital headaches, vomiting or nausea alone or accompanied by vertigo, generalized exfoliative dermatitis, morbilliform exanthema, transient intense oliguria, articular pains, neuralgic pains and tinnitus. All these symptoms proved reversible in short periods of time. Some improved greatly with benadryl.

Although we are not in a position to determine the exact prognosis during the course of treatment, we have noted that eosinophilia is a constant reaction to the drug. In this respect it seems to us that when the eosinophilic reaction mounts rapidly and remains above 14 per cent, it means a not too favorable progress and lack of efficacy in the treatment. The best results coincided with a lesser number of eosinophiles, rapidly descending to normal during treatment.

Also as far as progress is concerned, the radiologic study seems very interesting to us. One should not expect the disappearance of the radiological shadows as rapidly or simultaneously with the clinical improvement since there is no change in the pathological picture that causes the shadow. The time required for a change

in the pulmonary lesion is far longer than that employed in the treatment. We have made frequent examinations of our x-ray films and feel that early regression (between 45 to 60 days) indicates improvement. Moreover, we have also noted new infiltrative lesions appearing during the course of treatment which, of course, induced us to doubt a favorable outcome in these cases.

In this preliminary report we do not take into account the observation of American or English authors and base our conclusions on our personal experience.

Indications for streptomycin therapy are as follows:

- 1) For general therapeutic purposes in cases of acute, subacute or chronic hematogenous tuberculosis and for hematogenous lesion of the early exudative type.

- 2) For therapy in laryngeal and intestinal lesions regardless of the form or evolution of the associated pulmonary tuberculosis.

- 3) For restricted therapeutic purposes in any clinical form of pulmonary tuberculosis, for extrapulmonary lesions or the complications mentioned above.

Finally, we would like to mention that in some of our cases we contemplate after the beneficial effect of streptomycin the application of surgical collapse which could not be considered before because of the type of lesion, the advanced state of the disease, the precarious general condition. Under these circumstances, the cases were far beyond the minimal requirements for surgical interference.

The above statement confirms our opinion that there is another indication for the use of streptomycin as an auxiliary treatment to obtain improvement before the application of the classic methods of collapse therapy.

RESUMEN

La utilización de la estreptomicina para el tratamiento de la tuberculosis pulmonar está justificada en los siguientes términos:

- 1) Con intención terapéutica general, para los casos de tuberculosis hematógenas agudas, subagudas y crónicas y para las no hematógenas de tipo exudativo reciente.

- 2) Con intención terapéutica sindromática para las lesiones de laringe y de intestino, cualquiera sea la forma pulmonar a la que esté o estén asociadas y cualquiera sea el tipo de evolución de las mismas.

- 3) Con intención terapéutica restringida, en cualquier forma clínica pulmonar, para las localizaciones extrapulmonares o complicaciones que más arriba se han mencionado.

Diremos, por último, que en algunos de los casos que sirven de base a ésta experiencia se considera en la actualidad, y después

del beneficio logrado con la medicación estreptomícínica, una posibilidad de colapsoterapia quirúrgica, posibilidad que no pudo tenerse en cuenta antes del tratamiento, por el, tipo lesional, la evolución de la enfermedad y el precario estado general, que excedían en mucho al mínimo requerido para tales intervenciones. Señalamos con esta conducta una otra forma racional de aprovechar los beneficios que ha traído la aplicación de la estreptomícina, aumentando la eficacia de la misma en aquellos casos en que no rinde sino resultados parciales por la aplicación de los clásicos métodos colapsoterápicos

Streptomycin in the Treatment of Human Tuberculosis*

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Following the demonstration by Hinshaw¹ and McDermott² that streptomycin affects favorably the course of human tuberculosis, the Veterans Administration, in collaboration with the Army and Navy, organized one year ago a cooperative investigation to study these effects. This was to be carried out simultaneously in nine service hospitals, but since that time the study has been enlarged to include 22 hospitals. The present report will summarize the results of treatment in 650 cases of various types of tuberculosis treated in 20 Veterans Administration hospitals.

Approximately 80 per cent of the patients were treated uniformly and according to the terms of protocols designed by the streptomycin committees of the organizations concerned. The remainder were what we have chosen to call "panic" or "unusual" types of tuberculosis and were not observed in as uniform a manner.

The vast majority of cases were required to have either pathologic or bacteriologic proof of the diagnosis before treatment was started—the exceptions to this requirement will be remarked upon. The patients treated in accordance with the terms of the protocols were selected and observed in a consistent fashion. Adequate and periodic notations of blood, kidney, and otologic functions were made before and during treatment and frequent bacteriologic, roentgenographic, and clinical examinations were recorded.

Results of streptomycin therapy will be described in the following types of tuberculosis: Pulmonary, 306 cases, draining cutaneous sinuses, 82 cases, upper respiratory ulcerations including tracheo-bronchial and laryngeal lesions, 73 cases, meningitis, 71 cases, acute disseminated miliary tuberculosis, 24 cases, genito-urinary, 38 cases, bone and joint, 25 cases, enteritis, 7 cases, peritonitis, 9 cases, pericarditis, 8 cases, tongue, 10 cases, and eye, 4 cases.

The dosage of streptomycin in most instances was 1.8 to 2 grams

*A speech delivered by Dr. Paul A. Bunn, member of the Veterans Administration Committee on Streptomycin, before the American College of Chest Physicians in Atlantic City on June 8, 1947. The cases referred to in its text are amongst the group described in a report to the Council on Pharmacy and Chemistry of the American Medical Association and published in the *Association's Journal* on November 8, 1947.

daily, injected intramuscularly in 5 or 6 doses, and the duration of treatment varied from 7 to 150 days, although the extremes of this variation concern only the less common types of tuberculosis. In the pulmonary cases, which comprise one half of the total number, the duration of treatment was 120 days unless some toxic manifestation altered that regimen.

The results of treatment can be divided into 3 categories (1) The group of tuberculous lesions in which the effect of streptomycin seems clear cut and impressive, namely, in cases with draining cutaneous sinuses, upper respiratory ulcerations, glossitis, ileocolitis, and peritonitis (2) The group of tuberculous lesions in which the therapeutic efficacy of streptomycin is less well defined, namely, in pulmonary, genito-urinary, orthopedic, pericardial, and ophthalmologic (3) The group of disseminated tuberculous lesions, i.e., miliary and meningeal tuberculosis, in which the place of streptomycin is not only well defined and impressive but also in which it is the only known therapy of any effectiveness.

GROUP I

Cutaneous Sinuses The data in Table I indicates the profound effect that streptomycin exerts upon tuberculous cutaneous sinuses. In over 80 patients, with an average of 3 to 4 sinuses in each, a "cure" rate of 80 per cent occurred. The lesions treated were all over 3 months' duration and many had been open and draining for as long as 5 years. In the table, the good results are, if anything, underestimated, for in the group of 10 per cent listed as improved, there were favorable changes, unexpected from any previous experience by physician or patient, but little short of complete healing. In every patient with multiple sinuses, at least one healed.

During the treatment period, no major accessory surgical procedure or local therapy was employed. Many of the sinuses were incised to allow better drainage of underlying collections of pus, but no radical incisions and drainages were attempted.

TABLE I

TUBERCULOUS SINUSES WITH CUTANEOUS DRAINAGE TREATED WITH 18 GRAMS STREPTOMYCIN DAILY FOR 120 DAYS

Number of Patients, Majority had Multiple Lesions		82
Duration of Lesion, Months		3 to 60
Results	Complete Healing	80%
	Improved	10%
	No Change	10%

The speed with which improvement occurred must also be mentioned. Many sinuses healed within a month and a majority within 60 days.

Other Tuberculous Ulcerations Tuberculous ulcers of the upper respiratory tree and alimentary tract, including pharynx, larynx, trachea and bronchi, tongue, ileum, and colon, responded well to streptomycin, following treatment for from 7 to 90 days. All of these benefited considerably more from intramuscular injections of streptomycin than from its use by other routes such as aerolization, nebulization, local, or oral. Although symptomatic benefit often resulted from the use of these latter routes, adequate blood serum concentrations cannot be attained by them and complete benefit could not be expected.

Regardless of the extent, type and response of the pulmonary tuberculosis accompanying the laryngeal, pharyngeal, and tracheo-bronchial lesions under observation, complete and lasting healing of the ulcers occurred in a vast majority of the 73 patients treated with streptomycin. The rapidity of this healing was remarkable, some cases showed repair of ulcerations within 7 days, and most were healed within 30 days.

A majority of the patients in this group were treated at the San Fernando Veterans Administration Hospital under the direction of Doctors Emil Bogen and Lyman Brewer. All of these patients were bronchoscoped at least twice before streptomycin was started and at bi-weekly intervals during the treatment period, so that the trend of disease was well recorded. No case was given streptomycin if there was any tendency of the lesion to heal during the pre-treatment observation period.

Seventeen cases of alimentary tract disease have been treated, 10 cases of tongue ulcerations and 7 with enteritis. As in the group previously described, the intramuscular route of administration has proved to be the best method to produce satisfactory response. Both local therapy to the tongue and ingested streptomycin have been tried in some patients, prior to a shift to the parenteral route, but in each instance the rapidity and completeness of the response have appeared significantly better by the latter method of administration.

There has been a dramatic symptomatic improvement in all cases of enteritis treated with streptomycin. No case has been included in the series unless he had had a positive sputum and severe gastro-intestinal symptoms. It was not possible to obtain specific bacteriological or pathologic proof of diagnoses in these individuals but, in most, typical roentgenographic observations were recorded so that the clinical impression of ulcerative tuber-

culous enteritis could be reasonably well supported. Very rapid relief of diarrhea, distension, and flatulence was noted, and the stools became normal in consistency and amount. X-ray evidence of healing has not matched the clinical response. However, a majority of these cases have been treated since January 1947 and it is quite possible that sufficient time has not elapsed for the changes to have become obvious by x-ray.

Nine cases of peritonitis, proved by biopsy at laparotomy, have improved symptomatically and the patients have lost all signs of infection following a course of streptomycin. The dosage of 2 grams daily has been continued for 60 days in most, as was done in the cases of enteritis. It would be difficult to describe the pathological changes coincident with this improvement because only by a second exploration could the investigator observe objectively what had taken place within the abdomen. This procedure has not been performed.

GROUP II

The place of streptomycin in the treatment of bone, joint, genitourinary and pulmonary tuberculosis is less well defined although its use is accompanied in most instances by some type of improvement. The greatest efforts in the Veterans Administration studies have been and are being directed toward defining precisely the position of streptomycin in the therapy of these commonest types of human tuberculosis.

In all three groups, a daily dose of 1.8 or 2.0 grams has been used and most patients have received the drug for 120 days. No local or accessory therapeutic measures have been employed during streptomycin treatment.

Pulmonary The protocol allowed only those patients to be treated whose tuberculosis had been under observation for at least two months and in whom the tuberculous process had proved to be progressive or, at best, stationary. Other forms of therapy including the amount of bed rest, were maintained at levels similar to those existing prior to the administration of streptomycin.

The most important measurable effect that streptomycin could be expected to exert on the course of tuberculosis should be demonstrable in x-ray films. Films from 157 cases in which treatment had been completed were reviewed by a jury of 12 physicians at the third streptomycin conference in St. Louis early in May 1947. The jury, composed of physicians whose experience in clinical tuberculosis and roentgenology well qualified them, and who had not previously seen the cases, was asked to answer specific ques-

tions, on score cards, about the x-ray films after a review of each patient's series of films, taken before, during, and after streptomycin

The opinion of the jury and that of the individual investigator who managed the cases can be summarized briefly. The effect of streptomycin on proliferative lesions was negligible. A majority of the jury voted that 81 per cent of exudative lesions improved, i.e., became smaller in extent, harder in type, or disappeared. They indicated that visualized cavities, either old or new, became smaller or closed in 65 per cent of the cases. The most remarkable vote concerned the question of whether, in the juror's opinion, the frequency with which the observed changes could have been expected to occur with bed rest alone. In the judgment of the jury, 50 per cent of the cases showed improvement following streptomycin which it had rarely or never seen before.

In the observations upon the entire group of 306 cases by the responsible investigators, over 70 per cent showed some evidence of improvement either clinical or by x-ray, regardless of the type of pulmonary disease under consideration.

The conclusion to be drawn from a review of x-ray films alone is that while streptomycin has the ability to reverse the trend of unfavorable disease and to aid in the unusually rapid resolution of exudative disease, it has not been seen to "cure" any pulmonary lesion. It must be emphasized that, in this series of 306 cases, streptomycin was given to a group of patients whose previous tuberculous history showed an unfavorable course and whose treatment was unchanged in other respects.

Streptomycin is an antibacterial agent—it has the ability to inhibit the growth of tubercle bacilli in the human to a degree never before observed with any agent. It has been shown in this series of cases that it does everything that could be expected of such an agent. This or any other antibiotic cannot be expected to alter permanent pathological changes in the lung. The improvement observed in these patient's x-ray films is the result of the body's ability to heal or resolve the inflammatory lesions during the period when the infecting organisms are not capable of active growth. It could have been predicted that caseous tissue, fibrosis and cavernous disease would be far less affected than reversible exudative lesions. This prediction is borne out by our series.

There are other effects of streptomycin in the course of pulmonary tuberculosis, more difficult to summarize and probably of less overall importance. Fever, when present, was reduced in most instances, cough lessened in severity and frequency, sputum became less purulent and less in amount, sedimentation rates tended to become lower, gain in weight varied considerably but

was striking in many, and the subjective improvement was marked in the majority of patients

During the treatment period, less than 10 per cent of the individuals showed progression of their disease, and this occurred usually in the fourth month of therapy. Whether or not these treatment failures have been due to the organisms' gaining resistance is unknown, as the bacteriological data on them are not yet complete. It is to be anticipated, however, that the failures, during treatment, can be explained by this mechanism.

Relapses occurred in the post-therapy period in 20 per cent of the cases. In a few, re-treatment failed to produce a second improvement and in these instances, where the information is available, the organisms were found to be resistant to streptomycin. In other instances, when re-treatment produced further improvement, the organisms proved to be still sensitive. Despite these examples that clinical response parallels the sensitivity of the organism, the cases are too few to warrant drawing any conclusion on this point from the Veterans Administration series. It is necessary to await further bacteriological and clinical correlations.

Bone and joint, pericardial, and ophthalmic tuberculosis have been treated with streptomycin in our hospitals. The information from the results of this therapy is too meagre to permit any conclusions. Certainly there has been no profound change in any case thus far treated, and although the various lesions have not progressed during therapy, there is nothing to indicate that any degree of benefit can be expected from streptomycin alone. It must be emphasized, however, that very few patients in these categories have been treated, and that the period of observation is too short to determine whether a favorable response will be obtained.

In the treatment of *genito-urinary tuberculosis*, a prompt and impressive improvement in symptoms, such as distressing urgency, frequency and pain of urination, has been commonplace following the use of streptomycin. Cystoscopic examinations, performed at routine intervals before and during therapy, have revealed that bladder ulcerations heal rapidly and that the degree of tuberculous cystitis is reduced considerably in the majority of patients. Pyelograms, on the other hand, have failed to disclose appreciable improvement in kidney defects due to tuberculosis.

GROUP III

The most exciting and the most remarkable effect that streptomycin exerts on the course of human tuberculosis has been demonstrated in miliary and meningeal tuberculosis. In the past, the mortality rate of acute disseminated miliary tuberculosis and

tuberculous meningitis has been 100 per cent or very near that figure With adequate dosage and with the proper administration of streptomycin, an appreciable reduction in this mortality will occur

Of 25 cases of miliary tuberculosis which have been treated, 20 are living Nine of these have been observed for from 2 to 20 weeks, following completion of treatment, they are in good health and all evidences of the miliary dissemination have disappeared both by clinical and roentgenographic signs Three others are about to discontinue treatment and all of them are similarly and remarkably well

In many of these cases, the focus from which the widespread dissemination originally occurred continues to be active, but the fatal complication has apparently been controlled by streptomycin

Five cases have died, 3 of them within 6 weeks following the beginning of treatment All 3 were moribund when streptomycin was started and streptomycin had no obvious effect on the course of their disease Two others died after 110 and 120 days' treatment Both had had an initial profound improvement, including the disappearance of x-ray lesions, but despite continuation of therapy, re-dissemination occurred and the patients died Presumably, these are instances in which the organisms became resistant to streptomycin and the individual, despite the initial help of the antibiotic, could not control the infection when its antibacterial effect was lost

Although this survival rate (I question the advisability of using the term "cure rate") of 80 per cent is remarkable, it may produce a sense of false security in the physician treating the case A serious hazard has been noted, during or after therapy, which makes it unwise to declare that streptomycin is a wonder drug in this type of tuberculosis Five cases have developed fatal meningitis during therapy for miliary tuberculosis and two others have developed meningitis 3 months after cessation of streptomycin therapy, originally given for acute miliary tuberculosis All seven of these individuals will die or have died, and presumably the lack of response during re-treatment has been due to the organisms' having become resistant to streptomycin

The treatment of meningitis with streptomycin is similarly remarkable even though the mortality rate will still, apparently, be in the neighborhood of 90 per cent Of the 71 cases of meningitis, with or without evidences of acute miliary dissemination, 28 are still living and of the 43 who died, 29 (70 per cent of deaths or 40 per cent of total) expired within 6 weeks without streptomycin having had any effect on their course All 29 were in coma when treatment was started

Eight individuals have finished a course of treatment and have remained more or less free of central nervous system infection for periods of from 30 to 110 days. Three of these, however, are in terminal stages of tuberculosis elsewhere in the body or have become decerebrate. The other five are in good health although four of them continue to have abnormal spinal fluid.

There are 20 others still under treatment. Most of these will probably die but hope for a "cure" is being held out for a few. Even though all should die, however, the very fact that 5 out of 71 individuals, all with proved tuberculous meningitis, have not only survived for periods of 4 to 8 months after the onset of the disease, but are in relatively good health, indicates the definite effect that streptomycin exerts on the course of this fatal type of human tuberculosis. That 7 to 10 others may also survive, merely adds prestige to that statement.

Toxicity Streptomycin is not free of toxicity, in fact, the vast majority of patients receiving it for periods longer than 3 weeks in the dosage we have employed will experience one or more untoward side reactions. Fortunately, few of these require the cessation of treatment, provided, of course, the proper indications for its use are present, reactions are rarely severe enough to endanger the patient's life.

The toxic reactions fall into three distinct categories. The first concerns the unique ability of streptomycin to injure the 8th cranial nerve. In the Veterans Administration series of 650 cases, over 95 per cent completely lost the function of their vestibular apparatus. This syndrome is characterized by the onset of dizziness and vertigo between the third and fifth week of continuous therapy. The vertigo and loss of balance cause the patient considerable discomfort during the first few days, but thereafter is noted only when he attempts to use his balancing mechanism. As evidenced by many tests of vestibular function, the entire labyrinthine apparatus dies, for a return of function does not occur following termination of the administration of the antibiotic. Although in the young individual, the cerebellum and muscles of the eye allow reasonably adequate accommodation for this loss, there is no question but that an absent vestibule comprises a distinct hazard to normal existence.

The auditory branch of the 8th nerve is involved only when high concentrations of streptomycin are present in the brain for relatively long periods of time. Loss of hearing, progressing to total deafness occurs, then, only in cases receiving streptomycin intrathecally, or when excessive doses are given intramuscularly, or when kidney function is so reduced that high blood levels above 80 mcg/cc, are being maintained. Fortunately,

the loss of hearing is slowly progressive so that the necessary laboratory procedures, performed over several days to a few weeks' time, allow treatment to be continued until the cause of the complication can be determined. A return of hearing is expected, in those instances in which the loss has not been complete, as soon as the irritant is removed. Complete deafness, on the other hand, is permanent when it becomes established.

Streptomycin, like many other chemotherapeutic agents, can be antigenic and cause a variety of delayed anaphylactic phenomena. The worst of these is exfoliative dermatitis. It is rare, but sufficiently common to force the clinician to perform those laboratory procedures which demonstrate the patient's sensitization. Cessation of treatment is of course imperative whenever such lesions develop.

Other hypersensitivity phenomena are commonly observed. Skin rashes, eosinophilia, circumoral paresthesias and other minor ones are examples. There have also been many instances of contact dermatitis among those who handle the antibiotic.

Streptomycin has been shown to be a kidney irritant. It affects the proximal convoluted tubules somewhat like a heavy metal and may produce irreparable damage to renal function. Casts are commonly observed shortly after streptomycin is first administered but in most instances further evidences of its irritant effect do not occur. In some cases, however, there are progressive urinary sedimental changes such as albuminuria and the presence of red or white blood cells. Whenever this sequence of events occurs, caution should be exercised in continuing treatment, for a reduction in renal function as evidenced by lowered PSP and urea clearances may follow.

There have occurred two instances of bone marrow depression, one in the Veterans Administration series, which developed during long-term streptomycin therapy. As this complication is so rare and as the depression is not permanent, mere mention of its possibility is sufficient.

SUMMARY

1) The Veterans Administration has undertaken a large scale investigation into the clinical and toxicologic effects of streptomycin in the treatment of human tuberculosis. The treatment was given in accordance with the terms of protocols designed by representatives of the Veterans Administration, Army, and Navy, and was carried on in 20 cooperating Veterans Administration hospitals.

2) The results of treatment of 650 cases of various types of

tuberculosis have been described. Because these are indicative of the fact that streptomycin exerts a favorable effect upon many types of tuberculosis, the present investigations are being continued and enlarged.

3) In some types of tuberculosis, namely, sinuses with cutaneous drainage, tracheo-bronchial, laryngeal and pharyngeal ulcerations, ulcers of the tongue and enteric tract and peritonitis, streptomycin has proved to be adequate and effective therapy when given by the intramuscular route.

4) In genito-urinary and in certain types of pulmonary tuberculosis, streptomycin has favorably altered the course of the infection in a majority of the cases.

5) The most beneficial effect in pulmonary disease occurred in exudative lesions. Less benefit was observed in fibrous, caseous, and cavernous lesions. No case was cured.

6) Bone and joint, ophthalmic and pericardial tuberculosis do not appear to be particularly benefited by streptomycin but experience with these lesions is meagre.

7) The expected mortality of meningeal and miliary tuberculosis has been lowered by the administration of streptomycin.

8) Toxic reactions upon the eighth nerve, kidney and organs of blood formation, and the delayed anaphylactic complications caused by streptomycin, preclude its use in all patients with tuberculosis. Its long term use must be accompanied by frequent and accurate laboratory procedures, and the disease under treatment must carry a prognosis sufficiently serious to justify the hazard of toxic effects from the drug.

9) Tubercle bacilli exposed to streptomycin eventually develop an overwhelming resistance to the antibiotic, so that the maximal therapeutic benefit to be anticipated will probably have taken place within 90 to 120 days in most cases. After resistance develops, further antibacterial therapy is probably useless, although this statement has not been decisively proved as yet.

10) It seems clear that streptomycin is capable of healing certain tuberculous lesions and of serving as an adjuvant to existing forms of therapy in other types of the disease. The precise indications for its use and the optimal dosage regimen have still to be learned in pulmonary, genito-urinary and bone and joint tuberculosis. The dosage schedule for treatment of respiratory, enteric and cutaneous ulcerations and disseminated tuberculosis is better defined. Further intensive and long term studies are necessary to learn how streptomycin can be most wisely and effectively used.

11) I should like to close by emphasizing, what I hope I have already made clear, that the work which has been described has

been carried out by investigators in many Veterans Administration hospitals and that my function here today is simply that of a reporter of what I believe to be good deeds

RESUMEN

1) La Administración de Veteranos ha emprendido una investigación en grande escala sobre los efectos clínicos y toxicológicos de la estreptomina en el tratamiento de la tuberculosis humana. Se administró el tratamiento de acuerdo con las estipulaciones de protocolos concebidos por representantes de la Administración de Veteranos, del Ejército y de la Marina, y se llevó a cabo en 20 hospitales cooperantes de la Administración de Veteranos

2) Se han descrito los resultados del tratamiento de 650 casos de varios tipos de tuberculosis. Debido al hecho de que estos resultados indican que la estreptomina ejerce un efecto favorable sobre muchos tipos de tuberculosis, se están continuando y amplificando las presentes investigaciones

3) En algunos tipos de tuberculosis, tales como las fístulas cutáneas, las ulceraciones tráqueobronquiales, laríngeas y faríngeas, las úlceras de la lengua y de los intestinos y la peritonitis, se ha comprobado que la estreptomina, administrada por la vía intramuscular, es una terapia adecuada y eficaz

4) En la tuberculosis génito-urinaria y en ciertos tipos de tuberculosis pulmonar la estreptomina ha alterado favorablemente el curso de la infección en la mayoría de los casos

5) En lesiones pulmonares el efecto más beneficioso ocurrió en las de tipo exudativo. Se observó menos beneficio en lesiones fibrosas, caseosas y cavernosas. No se curó a ningún caso

6) No parece que la estreptomina sea beneficiosa en la tuberculosis de los huesos y las articulaciones, de los ojos y del pericardio, aunque no se tiene mucha experiencia con estas lesiones

7) La esperada mortalidad de la tuberculosis meningea y miliar ha sido reducida mediante la administración de la estreptomina

8) Las reacciones tóxicas sobre el nervio octavo, sobre los riñones y los órganos de formación de la sangre y las complicaciones anafilácticas tardías causadas por la estreptomina impiden que se use en todo paciente con tuberculosis. Su empleo por un tiempo prolongado debe estar acompañado de procedimientos de laboratorio frecuentes y exactos, y la enfermedad bajo tratamiento debe llevar un pronóstico lo suficiente grave para justificar el riesgo de los efectos tóxicos de la droga

9) Los bacilos tuberculosos expuestos a la estreptomina desarrollan con el tiempo una resistencia abrumadora al antibiótico, de manera que el beneficio terapéutico máximo que se puede

esperar en la mayor parte de los casos probablemente tendra lugar en los primeros 90 a 120 días Después de haberse desarrollado la resistencia la terapia antibacterial probablemente no tiene valor, aunque esta declaración no ha sido comprobada decisivamente todavía

10) Parece evidente que la estreptomycina puede curar ciertas lesiones tuberculosas y puede servir de coadyuvante a las terapias existentes en otros tipos de la enfermedad No se han determinado todavía ni las precisas indicaciones para su empleo ni la dosis óptima en la tuberculosis pulmonar, génito-urinaria y de los huesos y las articulaciones Se ha definido mejor la dosis necesaria para el tratamiento de las ulceraciones respiratorias, entéricas y cutáneas y de la tuberculosis diseminada Precisa que se lleven a cabo estudios más intensos y prolongados a fin de descubrir la manera de emplear la estreptomycina en la forma más prudente y eficaz

11) Para terminar, quiero recalcar lo que creo que ya he explicado claramente, es decir, que la labor aquí presentada ha sido realizada por investigadores en muchos hospitales de la Administración de Veteranos y que yo solamente he relatado lo que considero ser buenos resultados

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- 1 Hinshaw H C Feldman, W H and Pfuetze, Karl H *J.A.M.A*, 132 778-782 (Nov 30), 1946
- 2 Farrington, R F, Hull-Smith, H Bunn, P A and McDermott, W *J.A.M.A*, 134 679-688 (June 21), 1947

Since this paper was delivered, many articles have appeared in the American literature concerning the place of streptomycin in the therapy of human tuberculosis Information from these indicates that the dosage and duration of its administration described herein are undoubtedly too great The Veterans Administration in its study now recommends, for most types of tuberculosis one gram of streptomycin daily given in two doses of $\frac{1}{2}$ gram 12 hours apart Only in those cases of truly acute tuberculosis should more be used Proper duration of therapy cannot yet be defined but it is probable that in most instances less than 120 days' continuous therapy is required

Recent publications arising from the cooperative study include

- 1 "Treatment of Tuberculous Sinuses with Streptomycin," *J.A.M.A*, 135 147 (Sept 20), 1947
- 2 "Editorial re dosage," *J.A.M.A*, 135 842 (Nov 29), 1947
- 3 "Treatment of Tuberculous Tracheo-bronchitis with Streptomycin," *Am Rev Tuberc*, 54 408 (Nov), 1947
- 4 Streptomycin Sensitivity," *J.A.M.A*, 136 614, (Feb 28), 1948
- 5 "Treatment of Millary and Meningeal Tuberculosis with Streptomycin," *Am J Med Sc* in press
- 6 Treatment of Enteric Tuberculosis with Streptomycin," *Am J Med Sc*, in press

D I S C U S S I O N

KARL H PFUETZE, M.D, F C C P
Cannon Falls, Minnesota

I would first like to congratulate Dr Bunn on his excellent paper His report of the combined experiences of the Veterans Administration Tuberculosis Service with streptomycin in tuberculosis during the past year is particularly welcome and timely We are deeply indebted to him and to all the physicians of the Veterans Administration whose research and clinical investigation made this splendid report possible

It has been my unusual privilege and opportunity to work in close collaboration with Drs Hinshaw and Feldman of the Mayo Clinic and Mayo Foundation in their investigation of streptomycin since it was first used clinically for human beings at Rochester, Minnesota in October 1944 During the past two and a half years we have used the drug in treating more than 150 patients suffering from various forms of tuberculosis It is especially gratifying to us that this report of the Veterans Administration based on such a large series of patients, confirms our clinical impressions gained from our earlier investigations on a much smaller scale Information and data from other investigators show the same general results

I believe we now can state definitely that streptomycin has proved to be a valuable adjunct in the treatment of certain forms of tuberculosis It has already become a "must" in treatment of tuberculous meningitis and miliary tuberculosis It is the treatment of choice in such forms of the disease as tuberculous laryngitis, ulcerative tracheobronchial tuberculosis, draining cutaneous sinuses and tuberculous enteritis

In pulmonary tuberculosis it is most effective in the treatment of soft exudative lesions of recent origin Old chronic fibrocaseous lesions are benefited little if any by its use

The optimal daily dosage, frequency of administration and duration of treatment have not been established as yet In our earlier investigations we used large doses, 2 to 3 gm daily in divided doses given every three hours day and night In December 1945, we began to use 1 gm daily in divided doses, given every six hours, for 120 days We wanted to determine whether a lower daily dose would be effective therapeutically and whether the toxic manifestations would decrease with the smaller dosage To date we have used this schedule of doses for nearly forty patients The therapeutic results in this series were comparable to those obtained previously with the higher doses We also noted a sharp decrease

in toxicity in the patients receiving the smaller doses. It is our impression the 1 gm daily is preferable to the larger dose (2 to 3 gm daily) in the great majority of patients with the exception of those who have miliary or meningeal tuberculosis. However, not enough work has been done as yet on the problem of dosage to warrant anyone being arbitrary on this point. With so many workers investigating streptomycin throughout the country, this whole question of optimal dosage, frequency of administration and duration of treatment undoubtedly will be determined in due time.

The phenomenon of strains resistant to streptomycin which are noted not infrequently during the third and fourth months of treatment is incompletely understood. Unpublished data by Dr Pyle, as associate of Drs Feldman and Hinshaw in the Mayo Foundation, indicates that certain streptomycin-resistant strains of the organism are demonstrable *before* treatment is started. A vast amount of research must be done, both by clinicians and laboratory men, before this part of the puzzle can be fitted into the whole clinical picture.

One thing should be strongly emphasized. Streptomycin is *not* an overnight cure-all for tuberculosis. Like other valuable drugs, such as penicillin and sulfonamides, it has its assets, limitations and liabilities. It must not be considered as a substitute for sanatorium care, rest in bed and other well established methods of treatment, such as collapse therapy and other surgical procedures. Streptomycin should be welcomed as a valuable weapon to our armamentarium. We, as physicians, have a solemn obligation to learn its value and shortcomings, so that we may use it intelligently for the right patient at the right time, and in combination with such other therapeutic measures as may be necessary to achieve a good end result.

D I S C U S S I O N

W WAYNE STEWART, M.D.
Philadelphia, Pennsylvania

Dr Bunn's report is of great value to each of us. Our discussion is based on 100 cases of pulmonary tuberculosis treated with streptomycin. The only protocols for treatment were that the patient receive one gram of streptomycin daily, divided into 12 hypodermic doses for a period of eight weeks with periodic laboratory studies.

In these 100 cases there was no eighth nerve damage and the same results were achieved with one gram a day for 8 weeks, as when giving two to three grams daily for a period of three months or longer. One-twelfth of a gram given hypodermically every two hours maintains a blood serum level of approximately 10 to 15 micrograms per cubic centimeter of blood serum depending on kidney function. This is adequate to inhibit the growth of tubercle bacilli as only 5 to 75 micrograms are necessary, and yet this is not enough streptomycin to damage the eighth nerve, nor is it enough to develop eosinophilia or to produce abnormal urinary sediments. The drug is given for only eight weeks, because we have observed maximum effect from the drug in the first 6 to 8 weeks.

The results in these 100 cases agree with those presented by Dr. Bunn. It shows that in 80 per cent of individuals there was a striking change in the progress of the disease. Seventy-five per cent of these cases showed improvement in their x-ray films. In the clinical picture, there was lowering of the sedimentation rate, marked increase in appetite and hence weight gain, marked reduction of fever, less cough and expectoration, and each patient showed subjective improvement. We agree with Dr. Bunn that we must maintain collapse therapy along with the streptomycin in order to achieve the best end results possible. We do not agree with the Veterans Administration Protocols in allowing the patient to remain under observation for 60 to 90 days in order to decide whether the disease is progressive or regressive. It is believed that we should begin treatment immediately with the correct form of collapse therapy and streptomycin.

In our 100 cases each individual was taught to prepare his own streptomycin dilution, syringes, needles—and do it sterily, to inject himself as a diabetic is taught to take insulin, and to keep an accurate daily chart. The youngest patient was 14 years and the oldest 81. By this method we saved these patients \$90,000 of hospital expenses and an untold amount of nursing service. This is important today when our hospitals are overcrowded and with our shortage of nurses.

Now let us compare the results of these 100 cases with those 600 treated by the Veterans Administration.

- 1) All types of tuberculosis were treated and no case was allowed to be observed to see whether the disease was progressing or regressing.

- 2) Collapse therapy was instituted immediately with streptomycin therapy.

- 3) (a) One hundred cases were treated with no eighth nerve damage, i.e., in not one of these did we see a spontaneous nystag-

mus or deafness Only 4 per cent developed vertigo, three of whom were definite cardiacs and one had previous kidney damage
(b) Only 3 per cent developed a skin rash which disappeared by changing the lot numbers—that is to a different batch of the drug
(c) Only 1 to 2 per cent showed abnormal urinary sediments

4) Clinical changes were observed within 4½ days and later improvement was seen in 80 per cent of the x-ray films and in 30 per cent the sputum was converted from positive to negative

D I S C U S S I O N

FRANK WALTON BURGE, M.D., F.C.C.P.
Philadelphia, Pennsylvania

There are two subjects to be mentioned further regarding streptomycin therapy

1) We noted among the urinalysis reports on 100 cases treated with streptomycin that a trace of sugar was common It was suspected that streptomycin might be a reducer of copper solutions and the suspicion was confirmed by dropping a tiny amount of streptomycin solution, remaining in a syringe after it had been used for streptomycin injection, into the usual test tube of Benedict solution The copper was promptly precipitated

2) Many cases who found the hypodermic of 1/12th of a gram of streptomycin locally, painful and with swelling and redness at the site of injection, when the streptomycin was dissolved in physiological solution, had no local reaction or pain when it was dissolved in sterile distilled water This lead to investigation which indicated that streptomycin dissolved in water in the proportion used in this Clinic (one gram of streptomycin to 6 cc of solvent) was one-third stronger in osmotic pressure than body fluids, but when the same dilution was made using physiological saline solution as a diluent the osmotic pressure of the resultant solution was over two times as great as in body fluids, high enough to cause pain on injection

A Cooperative Study of Streptomycin in Tuberculosis*

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It seems advisable, before launching into a description of the tuberculosis research program administered by the Division of Research Grants and Fellowships of the National Institute of Health, to make a few remarks about the organizational aspects of the U S Public Health Service's entire program of grants in aid for medical research administered by this Division

Under the basic law by which the U S Public Health Service operates, the Surgeon General is charged with many responsibilities among which the following provisions of Section 301 of Public Law 410 are pertinent to my discussion today "The Surgeon General shall conduct in the Service, and encourage, cooperate with, and render assistance to other appropriate public authorities, scientific institutions, and scientists in the conduct of, and promote the coordination of research, investigations, experiments, demonstrations, and studies regarding the causes, diagnosis, treatment, control, and prevention of physical and mental diseases and impairments of man" In carrying out these provisions the Surgeon General is authorized, among other things, to make research grants in aid to universities, hospitals, laboratories, and to other public and private institutions, and to individuals for such research projects as are recommended by the National Advisory Health Council, or with respect to cancer, recommended by the National Advisory Cancer Council, or with respect to mental health, recommended by the National Advisory Mental Health Council In addition, the Surgeon General may adopt, upon recommendation of the respective Council, such additional means as are deemed necessary or appropriate to carry out the purposes of that part of the law I have just quoted The membership of the National Advisory Councils is comprised, for the most part, of outstanding non-government members who are authorities in medical science and public health fields, and also includes representation from Federal Government services

At the recommendation of the various National Councils which

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**Chief, Office of Public Health Research Projects, Division of Research Grants and Fellowships, National Institute of Health

are faced at their several meetings each year with the need for passing on the merits of large numbers of applications for support of research through research grants, a number of committees or panels have been established in most of the special fields of medical and related sciences. These groups, which are called Study Sections, are, as in the case of the various National Advisory Councils, comprised of outstanding authorities in their respective fields and include representation from other government agencies. These Study Sections make recommendations to the Councils in regard to research grant applications in particular fields. The need and the value of advice from such expert consultant groups is obvious, but the major responsibility of the Study Sections is to review their respective fields in order to promote and stimulate the undertaking of necessary research aimed at eliminating or minimizing the gaps of knowledge which are present or which develop as the result of current scientific efforts. The ability, training, experience, and interest of scientists giving so generously of their time and effort to this task is adequate assurance to all that the best possible direction is being given to the conduct of the surveys being carried out in the various research fields.

The membership of Study Sections varies considerably, some having a dozen members whereas others have as many as twenty or more. These Study Sections meet regularly, in advance of the meetings of the Councils. In addition, special meetings are sometimes called, whenever, in the judgment of the Study Section Chairman, circumstances warrant. To date, Study Sections have been established in the following fields: Antibiotics, Bacteriology, Biochemistry and Nutrition, Cardiovascular Diseases, Dental Research, Gerontology, Hematology, Malaria, Metabolism and Endocrinology, Pathology, Pharmacology, Physiology, Public Health Methods, Radiobiology, Sanitation, Surgery, Syphilis, Tropical Diseases, Tuberculosis, and Virus and Rickettsial Diseases.

With the aid of the members of the Study Sections and the three advisory councils, comprising some 250 of the leading scientists in the nation, a large-scale, nationwide, peacetime program of support for scientific research in medical and related fields has been in operation for almost two years. The underlying philosophy of this program is predicated on the complete autonomy of participating investigators. However, in certain cooperative projects, wherein a number of investigators are engaged in solving a specific problem common to all, such as in the Syphilis and Tuberculosis fields, complete autonomy for each investigator is not always practical. Nevertheless, I should like to emphasize that, in so far as the Federal Government is concerned, this program, based on research grants financed by public funds for the support of re-

search by independent scientists, is devoid of governmental control

An additional activity of the Division of Research Grants and Fellowships is the administration of the U S Public Health Service's Research Fellowship Program As you are probably aware, the Surgeon General has been given the authority to establish and maintain research fellowships Briefly, these fellowships are intended to promote the training and development of investigators in the fields of medical and related sciences, and are of four types

1) A predoctorate research fellowship at the Bachelor level is available to qualified applicants who have a Bachelor's Degree This fellowship carries a stipend in addition to tuition fees of \$1,200 for successful applicants without dependents and \$1,600 per annum for this fellowship awarded to persons with dependents

2) A predoctorate research fellowship at the Master level is available to qualified applicants holding a Master's Degree or its equivalent in graduate training This fellowship carries a stipend, in addition to tuition fees, of \$1,600 for persons without dependents and \$2,000 for persons with dependents

3) A postdoctorate research fellowship is awarded to qualified persons holding a Doctor's Degree in medical or related fields This fellowship does not provide tuition fees but carries a stipend of \$3,000 per year for Doctors without dependents and \$3,600 per year for those with dependents An increase of \$300 each year is granted to those Doctorate Fellows who are reappointed

4) Special research fellowships are awarded to applicants who qualify for a postdoctorate fellowship and in addition have demonstrated outstanding ability or who possess specialized training for a specific problem This fellowship does not carry a set stipend but is determined in the individual case

Application for a research fellowship is made to the Division of Research Grants and Fellowships where it is recorded and submitted to the Central Qualifications Board for consideration The Central Qualifications Board then sends the application to the appropriate Specialty Board for further review These specialty boards of which there are three, namely, The National Institute of Health Specialty Fellowship Board, The National Cancer Institute Specialty Fellowship Board, and The Mental Health Specialty Fellowship Board, make final recommendations to the Surgeon General on all applications for research fellowships So much for the over-all description of the activities of the Division of Research Grants and Fellowships

The Tuberculosis Study Section was established late in the Autumn of 1946, and held its first meeting in Washington, D C in December, 1946 The members of the Tuberculosis Study Section are

Dr Henry Stuart Willis, Chairman
Dr Carroll E Palmer, Exec Sec'y
Dr J Burns Amberson
Dr J B Barnwell (Vet's Adm)
Dr Emil Bogen
Dr Howard W Bosworth
Comdr Sidney A Britten (MC) U.S.N
Dr Rene J Dubos
Dr H Corwin Hinshaw
Dr Kirby S Howlett
Dr Esmond H Long

Dr Herbert L Mantz
Dr Walsh McDermott
Dr Edgar M Medlar
Dr J A Myers
Dr J McLeod Riggins
Dr Karl Pfuetze
Dr S J Shipman
Dr John H Skavlem
Dr Henry C Sweany
Dr Julius Lane Wilson
Lt Col Joseph R Vivas
(MC) U.S.A

In order to expedite the work of the Tuberculosis Study Section which is quite large, the Section established from its membership a Steering Committee comprised of Doctor Long as Chairman, and Doctors Hinshaw, McDermott, Medlar, Palmer, Riggins, and Willis as members

In addition, it has been found necessary to establish a committee on extra-pulmonary tuberculosis, membership of which includes Doctors Barnwell, Hinshaw, Mantz, Skavlem, and Walker, and a laboratory committee which includes Doctors Bogen, McDermott, Steenken, and Youmans

At the time of the formation of the Tuberculosis Study Section there were not available to the Division of Research Grants and Fellowships of the National Institute of Health sufficient funds to permit the establishment of the desired and necessary program of investigation. Fortunately, the Congress took cognizance of the need for research in the field of tuberculosis and appropriated one million dollars for this purpose

In establishing its plans for the present fiscal year the Tuberculosis Study Section members agreed that the planning of the Study Section should not be confined to the narrow limits of an evaluation of streptomycin but that a broad "over-all" program should be developed which would consider the whole problem of tuberculosis—that this program envision not only the testing of a single therapeutic agent, but provide plans for a more comprehensive search for the most effective therapy, including the development, the laboratory and animal testing, and the clinical trials of any antibiotic or chemical compound which might offer promise. They also agreed that the program include close scrutiny of present methods of supportive and surgical therapy with a view to their improvement and better application, and investigations of the basic facts of the mode of infection, of pathogenesis, of prognostic factors, and of preventive measures. However, in view of the restriction of funds, it was agreed that the program would have to be developed in a series of consecutive studies and that, initially, attention would be confined to the segment of the program covering the evaluation of the effect of

streptomycin on pulmonary tuberculosis and to necessary corollary studies

The essence of this plan is that a group of experts in the field of clinical tuberculosis, in different institutions in different parts of the country, agree to cooperate in a large scale, carefully controlled project, which is operated in such a way as to insure the collection of uniform observations that may be combined or pooled to furnish statistically significant evidence as to the value of streptomycin in the treatment of certain well-defined types of pulmonary tuberculosis

This plan necessitated the establishment of a Central Coordination and Analysis Office which is under the policy direction of, and responsible to the Tuberculosis Study Section and is, for administrative purposes only, in the Field Studies Section of the Tuberculosis Control Division

This Central Office is responsible for (1) The development and establishment of a record system designed to meet the over-all objectives of the Tuberculosis Study Section program, (2) the continuous appraisal of the adherence of the participants to the procedures agreed upon, (3) the preparation for distribution to members of the Tuberculosis Study Section and to the investigators, of periodic reports and analyses, and (4) the collection and analysis of data, and the preparation of papers for publication by the Study Section (The individual investigator retains the right to make any publication of his own material that he may desire)

For the purpose of aiding the Central Office in this latter function of analyzing data and publishing results a committee selected from the Study Section membership and called the Evaluation Committee has been established

As a basis for evaluation, two groups are being built up, a streptomycin group and a non-streptomycin group, which are comparable in all but one respect, the administration of streptomycin. In all other respects, the two groups receive comparable treatment, i.e., any therapy the clinician may deem advisable for a case. Case by case, comparability does not exist for other therapy just as it is impossible to secure case-by-case pairing on such simple items as age, sex, and color. But it may be expected that for the two groups as entities, the various forms of therapy will appear about equally in each. Comparison will be between one group receiving streptomycin and any other therapy indicated and another group receiving any therapy indicated except streptomycin. Therefore, the same criteria for conventional treatment applies to the two groups

In the selection of cases each cooperating institution submits to the Central Office the x-ray films and an abstract, on a pre-

scribed form, of the clinical record of each case which the principal investigator at that institution considers acceptable to the study and suitable for treatment with streptomycin. The data submitted on each case, carrying only an identification number assigned at the Central Office, is then reviewed by a Selection Panel.

The Selection Panel is a group of twelve clinicians, experts in the field of tuberculosis, who were appointed by the Study Section to select cases for this study. The actual task of selecting cases is on a rotation basis, three of the twelve members meeting at the Central Office every two weeks to study the x-ray films and clinical records submitted by the several investigators.

Cases which the Panel agrees are suitable are divided at random in the Central Office into two groups, one to receive streptomycin, the other to receive no streptomycin. The allocation of a case to the streptomycin or non-streptomycin group must be accepted as final by the institution submitting the case.

Each clinical investigator is entirely free to decide whether a case should be considered for streptomycin treatment. Having once decided that he is willing to give streptomycin or to withhold it for one year, he must necessarily accept the decision of the Panel and the play of chance as to which cases actually get the drug.

In regard to dosage, the protocol calls for only one dosage regimen to be used in the first stages of this study. This schedule is one gram per 110 pounds of body weight given intramuscularly in three equal doses at eight-hour intervals for 91 days.

Corollary to this clinical study there are ten investigators conducting basic laboratory research on such questions as streptomycin sensitivity of the tubercle bacillus, experimental toxicity of streptomycin in the middle ear, cavitation in tuberculosis, laboratory evaluation of streptomycin in tuberculosis, and other similar subjects.

In addition to the controlled study on the evaluation of streptomycin in certain types of pulmonary tuberculosis, a separate study is in operation to determine the comparative merits of various dosage schedules. The items under study during the first period of this investigation are the optimal duration of streptomycin therapy, the minimal effective daily dose of streptomycin, and daily therapy versus intermittent therapy.

The fourth phase of the Tuberculosis Study Section's research program is the study of extra-pulmonary tuberculosis. Because of the vast amount of preparation incident to the establishment of the pulmonary studies the protocols for extra-pulmonary investigations are not yet in finished form. However, the subcommittee on extra-pulmonary tuberculosis will have these protocols ready for consideration by the Study Section within the

next few weeks As soon as this work is completed, applicants applying for grants to finance studies of tuberculosis of the bone and joint, urinary tuberculosis, and so forth, will be considered

Lastly, and in addition to the above investigations, a small number of pilot studies, corollary to the planned program, and aimed at specific and limited targets are scheduled Two such investigations, a study of B C G vaccination in sarcoidosis, and a study of the effect of streptomycin on conversion of tuberculin positive reactors, are now in operation

Although time has not allowed me to give more than a brief sketch of the over-all research program administered by the Division of Research Grants and Fellowships and the program of the Tuberculosis Study Section in particular, I would like, in summary, to emphasize the following six points

SUMMARY

1) The U S Public Health Service has broad authority and a fairly large appropriation to support, by means of research grants, research in non-government institutions, and by means of fellowship grants, research fellowships aimed at increasing the number of adequately trained investigators

2) Applications for research grants must be recommended for approval by the National Advisory Council concerned, and applications for research fellowships must be recommended for approval by the Central Qualifications Board and by the Specialty Fellowship Board concerned

3) The volume of applications for research grants and the broad and varied scientific fields covered require the advice of consultants expert in the various fields

4) The Tuberculosis Study Section is one of twenty such expert groups established for this purpose

5) However, the major responsibility of the Tuberculosis Study Section and other Study Sections is not the consideration of grant applications but is the continuing review of the research needs in their special fields and the subsequent promotion, stimulation, and coordination of such research

6) The immediate task of the Tuberculosis Study Section is to complete an evaluation of streptomycin in the treatment of pulmonary tuberculosis, but its over-all responsibility and interest lies in the promotion of needed research in the whole general field of tuberculosis

RESUMEN

1) El Servicio de Higiene Publica de los Estados Unidos tiene amplia autoridad y cuenta con los suficientes fondos para man-

tener, mediante subvenciones a instituciones, programas de investigación en instituciones no gubernamentales y, mediante subvenciones a individuos, becas para la investigación, cuyo objeto es aumentar el numero de investigadores adecuadamente adiestrados

2) La Junta Nacional Consultiva interesada debe recomendar la aprobación de peticiones para subvenciones a instituciones, y las peticiones para becas a individuos deben ser recomendadas para su aprobación por la Junta Central Calificadora y la Junta de Becas de la Especialidad interesada

3) El numero de peticiones para subvenciones a instituciones y los vastos y variados campos científicos que ellas abarcan, requieren el consejo de consultantes expertos en los diferentes campos

4) La Sección para el Estudio de la Tuberculosis es uno de los veinte grupos expertos establecidos con este objeto

5) Empero, la responsabilidad principal de la Sección para el Estudio de la Tuberculosis, y de las otras Secciones de Estudios, no es el examen de peticiones para subvenciones, sino el repaso continuo de lo que necesita investigación en sus campos especiales y el fomento, estímulo y coordinación subsiguientes de tales investigaciones

6) La labor inmediata de la Sección para el Estudio de la Tuberculosis es completar el avalúo de la estreptomycin en el tratamiento de la tuberculosis pulmonar, pero su responsabilidad e interés principales consisten de promover las investigaciones necesarias en el campo completo de la tuberculosis en general

Surgical Treatment of Residual Cavities Following Thoracoplasties for Tuberculosis*

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During the past six years we have performed 875 consecutive stages of thoracoplasty upon 325 patients. These patients all had far advanced pulmonary tuberculosis with cavitation. In 35, bilateral cavitation was present. One hundred forty-five were over forty years of age and sixty were past fifty years of age. The operations were performed with a mortality rate of 0.94 per cent per operation and 2.5 per cent per patient. This low mortality rate in a group of patients which included such a large percentage of older individuals was a matter of satisfaction to us. Two hundred sixty-three patients were observed over a sufficiently long period of time postoperatively to be statistically valuable. Sixty-two per cent had a conversion of sputum evidenced by repeated seventy-two hour negative concentrates and cultures. Sixty-two patients were treated too recently to evaluate or could not be traced. Of the thoracoplasty failures, 79 patients were operated upon 89 times in an effort to arrest their disease and close their cavities.

Attempts of other surgeons¹⁻⁴ to analyze the cause of failure of primary thoracoplasty have brought forward a number of reasons, the most commonly offered of which are

- 1) Giant upper lobe or positive pressure cavities
- 2) Inadequate surgery, under which heading are included failure to remove a sufficient number or length of ribs or transverse processes, and too prolonged an interval between stages
- 3) Unfavorable location of the cavity
- 4) Heavy walled cavity or thickened pleura
- 5) The presence of pneumothorax or empyema

The residual cavity following thoracoplasty continues as a

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challenge to the ingenuity of thoracic surgeons in spite of the numerous attempts to solve the problem over the years Semb⁵ suggested an apicolysis, Coryllos and Ornstein⁶ reported open drainage with pedicled muscle flaps used to plug the cavities, Dolley and Jones^{7,8} and Alexander⁹ have suggested lobectomy or pneumonectomy, Matson¹⁰ used an extrapleural gauze pack, Eloesser¹¹ used open cavity drainage with a skin flap. Various types of revision operation have been reported by Davidson,¹² Coryllos,⁶ Hochberg,⁴ and Judd.²

Our first group consisted of 44 patients upon whom a revision thoracoplasty was performed. In the analysis of causes for failure of the original operation in this group, we were confronted with the fact that 30 patients had demonstrable tuberculous endobronchial disease and 12 had giant or apparent tension cavities. Inadequate surgery was conceded to be a major factor in 10 patients. These were the three major causes of failure although a number of lesser reasons were present in a scattered group of patients, as shown in Table I.

In some patients several factors may be involved as a cause of failure, therefore the table will not balance numerically.

In the earlier thoracoplasties of this series the transverse processes were not removed. As experience accumulated, however, we became more radical and the removal of the processes became almost routine. In addition, we disarticulate the ribs and often resect the first, second, and third costal cartilages at an antero-lateral stage. With the wider resection of ribs and processes, the resort to revision became less frequent.

Thirty-four of the 44 patients who underwent a revision thoracoplasty were over 40 years of age, the average age of the entire group being 40 years. Three of the operations were of a Schede type, performed in treatment of a residual cavity with empyema.

TABLE I
Causes of Failure of Thoracoplasty

Endobronchial disease	30
Giant or tension cavities	12
Inadequate surgery	10
Fibrous induration of lung	6
Thickened pleura	5
Bilateral cavities	5
Thoracoplasty over empyema	2
Tuberculous bronchiectasis	2

These patients were followed for an average period of 21 6 months after the last operation Conversion of sputum was determined only after a series of negative seventy-two hour concentrates and usually with one or more negative cultures

There was no surgical mortality and only one late death, due to progression of disease 32 months following revision Twenty-four patients converted their sputum postoperatively Two patients had a negative sputum preoperatively but had x-ray evidence of an open cavity Both remained negative and their cavities were apparently closed A satisfactory result was thus obtained in 59 per cent of patients (Table II)

Among the 18 therapeutic failures, 15 had tuberculous endo-bronchial disease Four of these also had bilateral cavitation Three of these patients were subsequently controlled by means of pulmonary excision and one by an open cavernostomy

The revision technique used was not radical In those patients who had not had the cartilages removed previously, an antero-lateral stage was the initial step, at which time the first three cartilages and regenerated ribs were removed Three weeks later the posterior incision was reopened and the transverse processes, if present, as well as all regenerated ribs were resected The first intact rib was also removed at this time No attempt was made to do an apicolysis or effect an extrapleural separation in the gutter Generous use was made of intravenous fluids and whole blood transfusions

Our statistics tend to give a more favorable view of revision than we actually hold The majority of our revisions were performed in the earlier part of the present series when the transverse processes were not removed As the original operation became more radical and as other methods of treatment of residual cavities became available, the use of revision became less frequent Given an adequate original operation and having in mind the role played by bronchial obstruction in preventing cavity closure, it is difficult to believe that a revision has much to offer The increased tissue rigidity resultant from the original thoracoplasty in addition to the mechanical factors remaining in the bronchus

TABLE II
Results of Revision Thoracoplasty

Total No Cases	D E A T H Early	Late	Sputum Conversion	Sputum Negative Preop	Per cent Satisfactory Results
44	0	1	24	2	59

or pulmonary parenchyma would make secondary cavity closure a difficult procedure

Our present concept of the revision operation is that it has proven to be safe, and in patients free of endobronchial disease who have had inadequate initial surgery, it is effective. Other more logical methods of treatment of patients with endobronchial disease make the use of revision in such patients questionable.

Extrapleural Pneumonolyses

Since Tuffier¹³ first described extrapleural pneumonolysis in 1891 and used fat as a filling for the extrapleural space in 1910, there has been a continued search for a satisfactory filling material. Fat, muscle, gauze, air, oil, and paraffin have all been used and as often abandoned. Bull¹⁴ in 1920 reported the use of extrapleural fat in an attempt to close residual cavities under thoracoplastic collapse. Nissen¹⁵ stated that extrapleural pneumonolysis could be used advantageously when, after the ribs are resected, a rigid system of cavities does not collapse completely. Hans Alexander¹⁶ advocated either a temporary gauze or permanent paraffin filling in pneumonolysis as a supplement to ineffective thoracoplasty. He reported no particular difficulty in making such a pleural separation. Matson¹⁰ reported the successful use of gauze in a plioform envelope for an extrapleural filling in patients with residual thoracoplasty cavities. Denk¹⁷ and Coryllos,⁶ on the other hand, reported technical difficulties in stripping the uncollapsed cavity from the regenerated ribs. Wilson and Baker^{18, 19} first reported the use of the polymeric form of methyl methacrylate (lucite) as an extrapleural filling.

Our first efforts toward residual cavity closure by extrapleural pneumonolysis were made in 1942 when gauze packing was inserted in the extrapleural space in a series of ten patients. In these operations a posterior approach was used through the bed of a regenerated rib or through the bed of the first previously unremoved rib. The dissection was extremely difficult. Adhesions in the gutter or in the apex in the area of the cavity usually made a complete separation impossible. In two cases the pleura was torn during the dissection and the effort was abandoned. Both patients recovered uneventfully. In eight patients a space was created after tedious extrapleural dissection which was considered adequate for packing. This was snugly packed with gauze and the wound was completely closed. After three weeks the wound was reopened, the pack removed and the wound then repacked at frequent intervals until the sinuses healed. Seropurulent drainage persisted for several weeks but all wounds eventually healed. There were no operative fatalities and no late deaths. Two cas

as stated, were abandoned without packing because of pneumothorax. In five patients cavity closure was not obtained and the sputum remained positive. In three patients cavity closure and sputum conversion were obtained. A 30 per cent rate of success did not seem sufficient to compensate for the danger of opening into the cavity and for the long period of drainage that resulted postoperatively, and the operation was abandoned.

Following Wilson and Baker's work^{18, 19} with methyl methacrylate as an extrapleural filling in 1946, a second series of extrapleural dissections following thoracoplasty failure was begun. In these patients the "lucite" balls were used as an extrapleural filling. In this group also there were ten patients. Two patients had two operations, one posterior and one anterior, in an attempt to develop a satisfactory space. In this group, also, the operation was abandoned in three cases because of an accidental tear of the pleura. In spite of added experience, the dissection in these cases was also tedious and difficult, owing to the invariable presence of dense adhesions over the area of involvement. In two patients cavity closure and sputum conversion were not obtained. In three patients the sputum was negative before operation but unmistakable x-ray evidence of persistent cavity was considered an indication for the operation. In two of these the cavity was closed and the sputum remained negative. In the third, a post-operative infection in the extrapleural space necessitated the removal of the lucite balls. Cultures of the pus revealed pyogenic organisms with no tubercle bacilli. The wound is still draining and the sputum remains negative. In two patients cavity closure and conversion of sputum were obtained.

In this series, also, the results obtained hardly justify the risks involved. We are satisfied from this series and from results in a larger group in whom the lucite pack was used as a primary operation that the material itself is superior to any previously used as an extrapleural filling. It is non-irritating, light in weight, and results in few infections. In spite of the reports of some

TABLE III
Results of Extrapleural Pneumonolyses

Packing material	No. of patients	Deaths	Sputum negative initially	Sputum converted	Failures	COMPLICATIONS	
						Traumatic pneumothorax	Infection
Gauze	10	0	0	3	7	2	8
Lucite	10	0	3	2	5	3	1
TOTAL	20	0	3	5	12	5	9

authors^{2 10 16} as to the ease with which the apex could be stripped and the lung freed from the gutter in these operations, we have had a great deal of difficulty in the dissection. Since there are other methods of treatment of these residual cavities more physiologically sound which yield a higher measure of success, we now reserve the extrapleural operation for a small group of patients who are not in satisfactory condition for lobectomy or pneumonectomy, in whom we feel the residual cavity will not close with the addition of a revision thoracoplasty and in whom an open cavernostomy with flap drainage is not possible. The results of the extrapleural group of operations are shown in tabular form in Table III.

Open Cavity Drainage

Open drainage of tuberculosis cavities is probably the oldest form of surgical therapy used in the treatment of pulmonary tuberculosis. Sauerbruch²⁰ in 1930 stated that the surgical management of tuberculosis had followed a roundabout way and was then back to the method with which it began, pneumonotomy. Alexander⁹ states that drainage of tuberculous cavities has been carried out in isolated cases for centuries but rarely has it been advocated with enthusiasm. Open drainage of tuberculous cavities has attracted the attention of a number of American surgeons.^{6 21 2 22} Eloesser expresses the most current opinion in his excellent analysis of tension cavities and standardizes the technique.

"It is not reasonable to attempt to collapse an insufflated cavity, the content of which is under positive pressure by removing the surrounding ribs, some method which abolishes or counteracts the insufflating mechanism would seem more logical. Incision and drainage of tuberculous cavities has been tried repeatedly only to be abandoned. The method is the earliest one of surgical treatment but it has been fraught with so many dangers and difficulties that none of the countless surgeons who have attempted it have remained faithful to it. A *sine qua non* for the cavernostomy with a valve skin flap is that the cavity have no bronchial communication, or a small one. In the presence of a large communication the valve will not produce a negative pressure."

Several European surgeons^{24 25} have recently reported favorably on open drainage of post-thoracoplasty cavities by the Eloesser technique. They were not greatly concerned with the patency of the draining bronchus. In the majority of cases after drainage, silver nitrate caustic stick was applied repeatedly to the cavity walls and bronchial orifices until the cavity was obliterated. Le Carboulec²⁵ states that in applying cauterization in caver-

nostomies it is not a question of obliterating a bronchus and hoping by this means to achieve cure of the cavity, of which it is tributary, by some atelectatic effect, but rather of destroying the tuberculous focus at its site. The cavity, once relieved of its caseous burden, heals, no matter what the means employed, by swelling and contraction of its walls. In his series of 21 cases published in 1945,²⁶ he reports 19 cures and two deaths, one from the too prolonged use of evipan and one from air embolism.

O'Brien²⁷ says, "Many cavities, apparently blocked, close readily after thoracoplasty. The only way we can be sure a cavity is blocked is to do a thoracoplasty first." With our present knowledge this is perhaps a good philosophy but it will inevitably leave us with a number of residual apical tension cavities. The anatomical attempts to obliterate that type of cavity by revision thoracoplasty or extrapleural compression have not been encouraging. There remains then a physiological approach, one method of which is by open drainage.

The most dramatic results from the use of streptomycin in tuberculosis have been obtained in patients with draining tuberculous sinuses. We have repeatedly seen patients with multiple chest wall and other sinuses connected with tuberculous bones and joints heal in a short period of time once drainage was established and streptomycin therapy initiated. This beneficent effect of streptomycin in sinuses caused us to wonder whether it could not be used in closing the sinus tracts following cavernostomy at an earlier date than would otherwise be possible. We were able to secure a supply for a trial and although the work is too recent to be of any statistical value, the early results are encouraging and justify a preliminary report.

Open cavernostomy by the Eloesser technique has been performed on eleven patients who had residual cavities after thoracoplasty. The first operation was done in 1942 for a slitlike upper lobe cavity following a seven-rib thoracoplasty in a 48-year-old male. The cavity drained for eighteen months and then closed spontaneously. The sputum has remained negative since shortly after the drainage.

The second patient was 37 years of age. He had endobronchial granulations around the right upper lobe orifice and a right apical cavity which enlarged under pneumothorax. A right thoracoplasty was performed in November, 1944. After the anterior stage, a Monaldi catheter was inserted into the cavity. The cavity apparently closed on completion of the thoracoplasty but reopened a month later and remained open in spite of a revision which was performed in August, 1945. A two-stage cavernostomy by the Eloesser technique was completed January 26, 1946. The sputum

became negative one month following cavity drainage and has remained negative. The culture from the sinus drainage was also negative for acid-fast organisms. By February 28, 1947, the tract had narrowed to a sinus and streptomycin was available. He was given 18 grams of streptomycin per day for two weeks. The skin flap was then freed, the sinus dissected and a graft of the pectoralis muscle used to plug the opening. The wound was closed tightly and streptomycin continued for two weeks postoperatively. Healing was by primary intention and the wound has not reopened. The sputum remains negative.

The third patient, a colored male 35 years of age, resulted in a fatality. He was admitted November, 1945 with a 5 cm cavity in the right upper lobe. There was granulation tissue around the right upper lobe orifice with resultant narrowing. A six-rib, right thoracoplasty was completed June 11, 1946. During both the first and second stage operations a traumatic pneumothorax was created. The lung quickly reexpanded on both occasions and no complications were encountered. On August 12, 1946, the sputum remained positive and a residual oval cavity persisted in the compressed upper lobe. A two-stage cavernostomy was decided upon. The gauze pack was removed August 21, 1946 after ten days and an opening made into the cavity with the electrocautery. Pneumothorax was not encountered at operation. The afternoon of the operative day, however, a pneumothorax developed and the temperature was elevated to 104° F. An intercostal catheter was inserted and suction applied. Penicillin in doses of 40,000 units every three hours was given. The lung reexpanded completely in ten days but the temperature remained elevated. He died suddenly 26 days postoperatively at a time when we were encouraged to believe he was recovering. Permission for a post-mortem examination could not be obtained. The occurrence of a pneumothorax following the reexpansion of two previous traumatic pneumothoraces and a subcostal gauze pack emphasizes the difficulty occasionally encountered in obtaining pleural fusion.

Eight other cavernostomies have been completed three months or longer. All of these patients have a negative sputum and a negative culture from the sinus tract. Four of them who had a cavernostomy completed from five to eight months ago, were given a month's course of streptomycin and the sinuses closed. Streptomycin was continued for a month postoperatively. Three are completely healed and one has a small amount of superficial drainage which is expected to cease without further surgery. The sputum remains negative in each case. One patient who completed his cavernostomy three months ago is on streptomycin preliminary to an attempt to close the tract. Three patients have a negative

sputum but the amount and character of the drainage prevents an early attempt at closure

In summary, then Eleven patients have completed a cavernostomy One patient died postoperatively, one sinus closed spontaneously, five were closed with the aid of streptomycin, one is being prepared for closure, and three are draining actively All have a negative sputum (Table IV)

Pulmonary Excision for Tuberculosis

Following unsuccessful attempts at removal of tuberculous pulmonary tissue by Block²⁷ in 1881 and Ruggi²⁹ in 1885, Tuffier³⁰ resected the apex of a lung for tuberculosis and obtained a subsequent cure The patient died seven years later of meningitis In 1921 Jessen³¹ could find only 12 successful recorded instances of pulmonary excision for tuberculosis Thornton and Adams³² in 1942 were able to collect 29 cases of pneumonectomy and 46 cases of lobectomy for tuberculosis They added five cases of lobectomy of their own There were 44.8 per cent deaths in the pneumonectomies and 25.4 per cent deaths in the lobectomies In 1946 the reports by Sweet³³ and Overholt³⁴ were indicative of the trend toward pulmonary excision Sweet reported 27 lobectomies with 25.9 per cent total deaths and 13 patients apparently well with negative sputum In 36 pneumonectomies there were 14 deaths (38.9 per cent), operative and late, and 16 patients with a negative sputum Overholt³⁴ reported on 200 operations The case fatality rate in the lobectomies was 11.4 per cent and in the pneumonectomies 17.4 per cent There was a sputum conversion rate of 50 per cent These statistics were on the group of patients operated upon from 1944 to 1946 after the technique of operating in the face-down position had been developed

In the past 18 months lobectomy or pneumonectomy has been performed on 14 patients at the Oteen Hospital who were considered thoracoplasty failures These operations were performed by the senior author or by Dr Julian A Moore, consultant in thoracic surgery In the first case a left upper lobectomy was done for a residual cavity which had persisted in spite of a previous thoracoplasty Recovery was uncomplicated and he was

TABLE IV
Results of Cavernostomy

Patients	Deaths	Sputum negative	Sputum positive	Sinus closed
11	1	10	0	6

ultimately discharged with an arrested status after completing the required period of rehabilitation

The second patient had a right upper lobectomy December 28, 1945, for a residual thoracoplasty cavity. He developed a moderate spread in the perihilar area of the contralateral lung and a positive sputum has persisted. The spread was stabilized with the aid of pneumoperitoneum treatment and he left the hospital AWOL in December, 1946. He was clinically well but the sputum was positive.

In the third case a left upper lobectomy was done for a residual cavity following a five-rib thoracoplasty performed in May, 1945. The lobectomy was done January 17, 1946. The postoperative course has been complicated by a mixed empyema with Friedlander's bacillus as the predominating organism. A bronchocutaneous fistula was also present. After a prolonged and often dangerous course, aided by streptomycin therapy the wound has nearly healed. The sputum has been repeatedly negative on concentrate and culture. He is still a bed patient but will ultimately recover.

The fourth patient had a right upper lobectomy for residual cavity on March 14, 1946. He presents our only fatality. He was a colored male 25 years of age who had a six-rib thoracoplasty completed February 23, 1945. He had a moderate hypertension with a blood pressure averaging 140/90 preoperatively. Following lobectomy the temperature was elevated to 103° F for ten days. It had started to fall by lysis, however, when on the thirteenth postoperative day he died suddenly. Permission for autopsy was refused but it was felt that death was due to a pulmonary embolism.

The experience gained from these four cases convinced us that the operation had merit but that complications made it hazardous. At this time we became familiar with Overholt's³⁴ technique of operating in the face-downward position. We were able, without expense, to modify our Albee-Comper orthopedic table so that it could be readily adapted to operating upon patients in the prone position. At the same time, streptomycin became available to us. Since adopting the Overholt position and with the pre- and postoperative use of streptomycin, we have been able to do six successive pneumonectomies and four lobectomies for residual thoracoplasty cavity without a serious complication and with an apparent conversion of sputum in each case. Equally as favorable results were obtained in four other cases of pulmonary excision which were done as elective measures without a previous thoracoplasty. Although several of these cases were done too recently to consider the results permanent, the evidence at hand convinces us that lobectomy or pneumonectomy for a residual thoracoplasty cavity is a safe procedure in a properly selected case if

- 1) The operation is performed in the prone position
- 2) Streptomycin is administered pre- and postoperatively
- 3) A skilled anesthetist is available
- 4) Blood in adequate amounts is used to replace loss and to combat shock

The results of our lobectomy and pneumonectomy group are shown in Table V

SUMMARY

1) In an effort to salvage 79 failures from a series of 325 patients who had undergone a thoracoplasty, 89 secondary operations were performed

2) Fifty of these patients had a conversion of sputum, a salvage of 68.8 per cent

3) These secondary operations were performed with only two deaths, an operative mortality of 2.5 per cent

4) In the light of our present knowledge, the best results in cases of thoracoplasty failure are obtained with lobectomy or pneumonectomy

5) If a single cavity persists in a patient unsuited for excision, an open cavernostomy offers a good chance of sputum conversion

TABLE V
Results of Excision Therapy

	Number	Deaths	Negative sputum	Empyema	Spread
Lobectomy	8	1	7	1	1
Pneumonectomy	6	0	6	0	0
TOTAL	14	1	13	1	1

TABLE VI
Results of Entire Series

	Number	Deaths	Sputum negative preop	Sputum converted
Revision	44	1	2	24
Extrapleural gauze pack	10	0	0	3
Extrapleural lucite pack	10	0	3	2
Cavernostomy	11	1	0	10
Excision	14	1	0	13
TOTAL	89	3	5	52

RESUMEN

1) Se realizaron 89 operaciones secundarias en 79 fracasos de la toracoplastia en una serie de 325 pacientes

2) Se convirtió el esputo en cincuenta de estos pacientes, es decir, se salvó al 68.8 por ciento

3) Se llevaron a cabo estas operaciones secundarias con sólo dos muertes, o sea una mortalidad operatoria del 2.5 por ciento

4) A la luz de nuestros conocimientos actuales, los mejores resultados en casos en que fracasa la toracoplastia se obtienen mediante la lobectomía o la neumonectomía

5) Si queda sólo una caverna en un paciente no apropiado para la extirpación del pulmón, la cavernostomía abierta ofrece la mejor oportunidad de convertir el esputo

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Clinical Application of Angiocardiography*

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Visualization of the heart chambers and large vessels with contrast substance permits a demonstration of the normal and abnormal anatomy, congenital anomalies, and aids in the differentiation of vascular from nonvascular mediastinal lesions. This procedure may be used to demonstrate (1) the veins in the upper extremity, (2) character of the pulmonary circulation, (3) collateral circulation attending obstructing lesions at the thoracic inlet, (4) morphological changes in the large afferent and efferent vessels of the heart, (5) and the thoracic and abdominal portions of the aorta. Attempts to demonstrate the arterial supply to abdominal viscera by this method were not entirely successful. The procedure starts as a venographic examination, and terminates as an arteriographic one.

Historical

In 1931, Forssmann⁶ of Germany, introduced a ureteral catheter into the right auricle by threading the arm vein. In the same year, Moniz, Lopo de Carvalho, and Lima³ injected sodium iodide, without the aid of a catheter, into the arm and leg veins of monkeys and dogs hoping to demonstrate the pulmonary vessels, and called this procedure "angiopneumographie." Their results were not satisfactory, and they concluded that it would be necessary to catheterize the right auricle. In 1932, Ravina, Sourice and Benzaquen^{2,9} injected sodium iodide, abrodil and tenebryl into dogs. In 1933, Reboult and Racine² experimentally attempted cardiac ventriculography by direct puncture of ventricles in anesthetized dogs, injecting tenebryl. They did demonstrate the left ventricle and aorta radiographically. In 1935, Contiades, Unger and Naulleau² studied the then available contrast media used for arteriography and concluded that the available substances could be tolerated in the living without provoking any appreciable respiratory or circulatory changes. In 1936, Ameuille, Rennaeuz, Hinaurt, Desgrez and Lemoine² presented a communication on lung arteriography to the Medical Society of the Hospitals of

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Paris They passed a catheter into the right auricle, used sodium iodide and opacified the right heart chambers, pulmonary arteries and their branches

The preceding authors did not particularly concentrate on the visualization of the heart chambers and large vessels—their prime interest was the pulmonary circulation In 1931 Castellanos and his associates^{1 3 4 5} attempted cardiovascular visualization in children, using 8-12 cc of a 30 per cent solution of sodium iodide, injected through an arm vein without a catheter He demonstrated the right auricle, superior vena cava, axillary and arm veins, and referred to this procedure as auriculography When the right ventricle was also demonstrated, he referred to the procedure as auriculoventriculography He and his co-workers obtained equally good results by injecting the internal saphenous vein Troublesome reactions attended their procedure, which disappeared when sodium iodide was replaced by Per-Abrodil and Uroselectan B

In 1938, Robb and Steinberg¹⁰ described a practical method for the visualization of the heart chambers and large vessels They used a stereoscopic plate changer and exposed two films with each injection of contrast substance In 1941, Sussman, Steinberg and Grishman¹² described a wheel for multiple exposure technic, and were able to make as many as 8 and 10 exposures during a single injection In 1943, Schwarzschild¹¹ described a spring type device for the making of multiple exposures, and also obtained 8 to 10 exposures during a single injection The late Dr Frank Lieberman⁷ was working on a different type of device for the making of accurately time spaced multiple exposures His ideas are being executed and the apparatus will soon be available

Technic

The technique employed has been previously described and is essentially that described by Robb and Steinberg^{10 14} Circulation tests are made prior to the injection of the contrast substance From the results one calculates approximately when the contrast substance will be in given portions of the heart and large vessels and exposures are made accordingly Fifty cc of a 70 per cent solution of diodrast is injected very rapidly in less than 2 seconds through the antecubital or any other arm vein Two exposures are made during one injection at predetermined time intervals Usually two injections are given at approximately a 15 minute interval, using two different positions This permits visualization of the right and left heart and large vessels in two different positions Considerable information is obtained by this procedure It is adequate for most examinations More information might be obtained with multiple or serial exposures during a single injection

With multiple exposures circulation tests may be omitted. Three injections have been given during a single examination. I have utilized this procedure in more than 250 individuals, mostly in the older age groups. Being with an institution for chronic diseases, my subjects have been mainly in the latter decades of life, my oldest patient was 93 years of age. Not having had too much opportunity for work with the younger ones, my material is mainly limited to the differential diagnosis of vascular from nonvascular mediastinal lesions.

Reactions

Most patients exhibit some type of reaction, some mild, others severe. I have had no fatalities. Immediately following the injection each individual experiences a flush over the head and neck with a profound sensation of warmth through the entire body. Some have a tendency to cough, others to salivate and become nauseous, others may gag or vomit, particularly if there is food in their stomachs. Some have an urgent desire to urinate and, or defecate. There is an accompanying weakness with a drop in blood pressure. The systolic drop may be as much as 80 mm of Hg. All of the above are transitory. Itching and an urticarial rash appear in some cases. These are quickly relieved by adrenaline. The injected vein may become thrombosed. Recanalization occurs. I recognize no contra indications to the examination. Good results are not obtained in large hearts, and in cardinals who are decompensating. Sensitivity tests are omitted.

Roentgen Findings

Angiocardiographic examinations have shown variations from the accepted radiographic anatomy in the normal and in the abnormal.^{12 15 16} These have been described and need not be repeated.

Before proceeding, I should like to state that, recently, in Havana I exchanged experiences with Drs. Castellanos and Pereiras. Before I left, Dr. Castellanos presented me with a few transparencies of congenital anomalies in infants. With his permission, I shall now show them to you (Fig. 1).

The following case histories show the clinical application of this procedure from a diagnostic standpoint.

Case 1 H.L. is a white male aged 77, admitted 12/11/44 with a transfer diagnosis of hypertensive cardiovascular disease and congestive heart failure. The patient was mentally confused, and his history was contradictory and unreliable. His chief complaint was pounding of the heart related to exertion and occasionally while at rest. He stated that this had its onset approximately two months prior to admission. There was

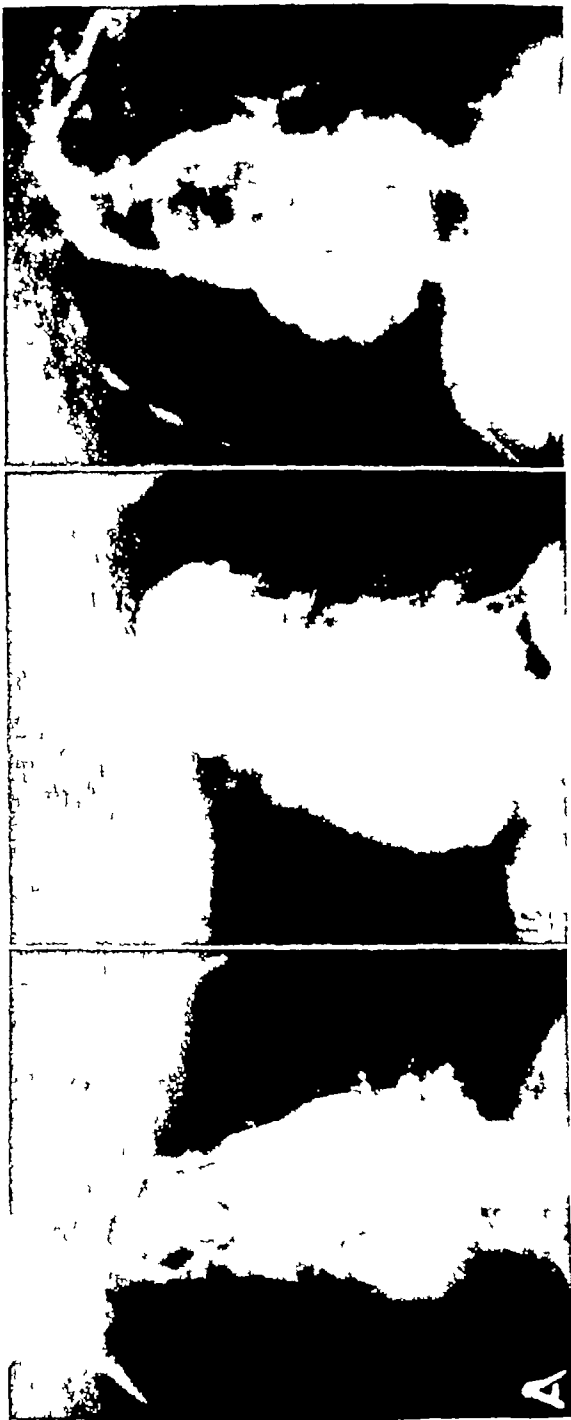


FIGURE 1 Congenital anomalies—Courtesy of Dr A Castellanos—(A) Contrast substance is visualized in two superior vena cavas, and right heart—(B) Aneurysmal dilatation of pulmonary aorta and left pulmonary artery—(C) Tetralogy of Fallot Contrast substance is visualized in the superior vena cava, right heart and aorta There is no contrast substance in the left heart

no history of hoarseness, dysphagia or chest pain. He had been a seaman all his life. He denied venereal disease, tuberculosis and pneumonia. He stated he had had "climate fever" in Rio de Janeiro many years ago.

Physical examination revealed a well developed but poorly nourished white male who was dyspnoeic and orthopnoeic. There were marked arterial pulsations over both supraclavicular fossae, which were compressible with much difficulty. The heart was enlarged both to the right and to the left. The heart sounds were markedly accentuated and revealed an irregular irregularity. There were no adventitious murmurs. Blood pressure was 210/120 in each arm. Dullness was obtained over the left anterior upper chest and in the left axilla. The liver edge was palpable one finger breadth below the right costal margin. There was no fluid in the abdomen and there were no abdominal masses. There was minimal ankle edema. Patient was digitalized on admission and has been doing well since except for pounding over his precordium and supraclavicular areas and occasional dyspnoea. A differential diagnosis between a tumor of the mediastinum and aneurysm was considered.

Laboratory findings. RBC has remained consistently around 5,000,000 and WBC about 8,500. Urea Nitrogen, 15.1 and 16.4 on two determinations. ECG on 12/13/44 showed auricular fibrillation, digitalis effect and myocardial damage. ECG on 11/25/46 indicated left ventricular strain, severe myocardial damage and 1st degree heart block. Wasserman test was negative. Bronchoscopy was performed on 2/7/45 and revealed no evidences of bronchial disease (Fig. 2).

Roentgen findings. Examination of the chest shortly after admission revealed a large dense mass in the anterior mediastinum and left upper thorax. The trachea was deviated to the right. A saccular aneurysm was diagnosed and angiocardiology was advised. On 8/28/45 a chest film was again reported as showing a saccular aneurysm. A kymographic examination revealed questionable pulsations in the mass. Consent was finally obtained and on 8/2/46 an angiocardigraphic examination was made, which revealed a large saccular aneurysm arising from the arch of the aorta, containing a thick mural clot.

Case 2. A.H., a white female aged 35, was referred by Dr. Joseph Cuono for study in September of 1946 with the following history. A loud systolic murmur at the base of the heart was first heard at the age of 18. During the past few years this loud systolic murmur at the base of the heart was transmitted to the vessels of the neck. Along with this a loud second aortic sound was heard. The murmur was loudest to the left of the upper sternum. At one time the possibility of this being a congenital lesion was considered. This was discounted, and considered as an aortic lesion secondary to a rheumatic infection. Roentgenograms of the heart showed considerable left ventricular enlargement and hypervascularization of the pulmonary fields. Patient has never decompensated. During pregnancy about 9 years ago she showed some elevation of her blood pressure and an arrhythmia, but went through pregnancy without serious difficulty and the blood pressure returned to normal. Sedimentation tests done occasionally over the past few years have been within normal range. On March 1, 1946, she became acutely ill with fever, chilliness and general aching. She continued to run a fever of 101.5 to 102.0 orally with some generalized aching but no localized joint pain. There was no response to salicylates. Blood cultures at first were negative. On March 26, 1946, she was admitted to a hospital, and at that

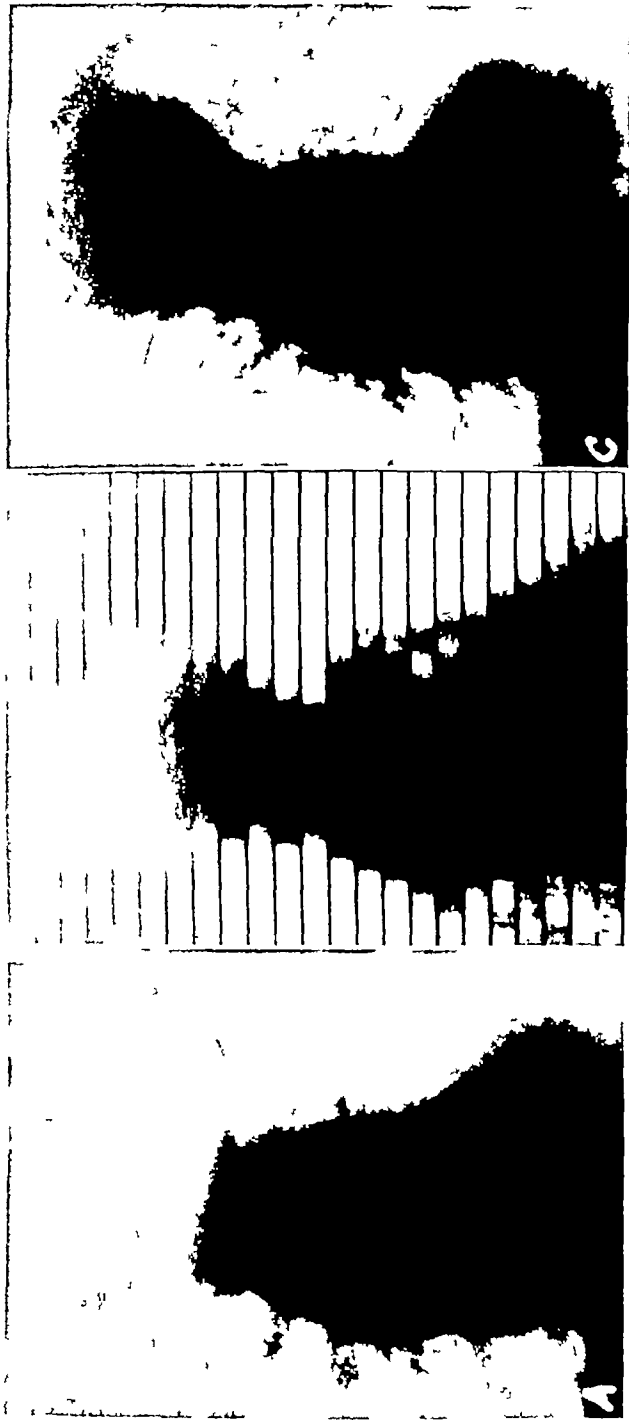


FIGURE 2, CASE No 1 (A) There is a large circular radio-opaque mass in the upper portion of the left pulmonary field —(B) Kymographic examination shows questionable pulsations along the left lateral margin of the mass —(C) Angiocardiographic examination shows contrast substance within the mass, demonstrating a large saccular aneurysm arising from the arch of the aorta, with a thick mural clot

time the blood culture was found to be positive for streptococcus viridans. During this period of illness she had complained of severe pain under the sternum, which was transmitted to the back. From March 29th, 1946 to April 27th, 1946, she received penicillin. For the first three weeks of treatment she received 1,800,000 units daily, and during the last week or ten days this was increased to 3,600,000 units because of persistence of fever (Fig 3).

A roentgenographic examination of her chest showed no increase in the size of the heart when compared with the previous examinations, but did show a rounded opaque density in the left hilar region, which was thought to be an enlarged gland, possibly on a tuberculosis basis because of a positive tuberculin test recorded while in the hospital. Repeated roentgenograms following the original one taken in the hospital have continued to show the same opaque density in the left hilar region. In the LAO projection this opacity partially compressed the trachea and left main bronchus.

Because of the persistence of the shadow in the left hilar region, the

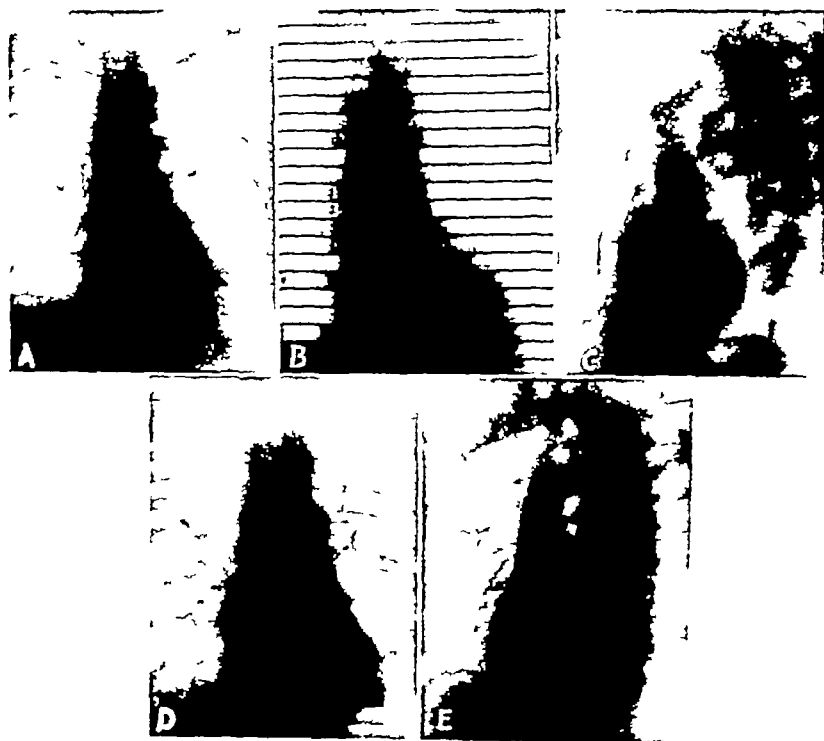


FIGURE 3 CASE No 2 (A) Increased width of the mediastinum due to a rounded radio-opaque mass in the region of the left hilum.—(B) Kymographic examination shows no pulsations in the area of the widened mediastinum.—(C) The mediastinal mass is visualized in the LAO projection compressing the lower portion of the trachea and left main bronchus.—(D) Angiocardiographic examination PA projection shows contrast substance in the left heart and within the mass at the left hilum.—(E) LAO projection shows contrast substance in the aorta and a segmental dilatation in the upper portion of the descending aorta corresponding to the shadow observed in 3C



FIGURE 4, CASE No 3 (A) Increased width of the superior mediastinum to either side of the median line—(B) Angiographic examination shows contrast substance in the right heart, superior vena cava, innominate and subclavian veins Acute angulation at the junction of the innominate and subclavian veins—(C) Large oval area of contrast substance is visualized in the superior mediastinum extending to the right of the median line The major portion of this shadow extends to the left of the median line, below it is merged with the aorta The subclavian artery is also visualized Contrast substance reveals a vascular lesion, an aneurysm arising from either the arch of the aorta, the innominate or left common carotid artery

possibility of an aneurysmal dilatation in this region, resulting from weakening of the wall of one of the vessels by the bacterial endocarditis, or an endarteritis, was entertained by her physician. No pulsations were visible on fluoroscopic examination. His opinion was that her heart lesion never had been an aortic one. A patent ductus had not been entertained because of the absence of the typical machinery type murmur. That the shadow represented a tumor in the posterior mediastinum was also entertained. The only change in the cardiac status noted during this time was the appearance of a more definite mitral systolic murmur after the onset of the bacterial endocarditis. Following her discharge from the hospital she ran a low grade fever, and her sedimentation rate was at the upper limit and slightly above normal. Her activity was limited. She was up and about the house, but did no work.

An angiocardigraphic examination revealed the mass to be vascular in origin, a segmental dilatation of the descending aorta.

Case 3 J.H., a white male, aged 40, was admitted 3/25/46, with a complaint of cough and head cold of three months duration. Patient stated that after having had this severe cough for two weeks he developed a pain in the area of the right upper sternum. This pain was constant and became worse with coughing. He noted a mass in this area for the first time, after two weeks of coughing. The transfer transcript from another hospital stated that the patient was a known leucemic, and the only record of therapy was 12 intramuscular injections in May 1945.

Physical examination revealed a 40 year old, well developed, fairly well nourished white male whose pupils reacted to light and accommodation. There was a prominent mass protruding from behind and over the right sterno-clavicular articulation into the neck which pulsated. There was no pain or tenderness in this mass. The trachea was in the mid line. The heart was increased in size to the left of the midclavicular line. The cardiac apex was in the 6th intercostal space. A was greater than P. The sounds were of good quality. There were no adventitious murmurs. On admission the blood pressure was reported as R-130/85 L-120/80. Prior to discharge, blood pressure was R-170/100, L-158/110. There was no peripheral edema. Pulsations were present in the dorsalis pedis arteries.

Laboratory findings: Hgb, 9 gms., RBC 3.3, WBC, 6600, Polymorphonuclears, 57 per cent, Lymph 37 per cent, Monocytes, 3 per cent. Venous pressure, 270 mm. Urea Nitrogen, 14. Kline test, strongly positive. Wasserman test, 3+. ECG examination on 3/27/46 was reported as regular sinus rhythm with left axis deviation. A clinical diagnosis of leucemic heart disease with an aneurysm of the right common carotid or innominate artery was made (Fig. 4).

A roentgen examination of the chest on 3/27/46 showed an increase in the width of the superior mediastinum to either side of the mid line due to a mass encroaching upon the apical and subapical portions of the right pulmonary field. There was no erosion of the adjacent ribs or vertebrae. The heart was enlarged to the left. The aorta was dilated and showed calcific plaques in the arch. A diagnosis of an aneurysm of the innominate artery was made.

To verify the diagnosis an angiocardigraphic examination was made on 4/16/46. In the PA projection the right heart was visualized with contrast substance in the pulmonary aorta, superior vena cava, innominate subclavian and axillary veins. The second exposure revealed

contrast substance in the aorta, with very little in the left heart. There was a slight narrowing of the mid transverse portion of the aortic arch. In the superior mediastinum there was a large oval area of contrast substance extending slightly to the right of the median line. The major portion of this oval shadow was to the left of the midline, and the lower margin was merged with the right lateral portion of the aortic arch. The subclavian artery was visualized and lay in close apposition to the mass just described. This mass exerted pressure upon and displaced the innominate vein to the right. There was an acute angulation between the subclavian and innominate veins, with narrowing of the lumen at the junction of these two veins. Evidences of a collateral circulation were present. In the left anterior oblique projection the entire right heart was visualized, with the vessels leading to and from the right heart. On the second exposure, contrast substance was visualized in the mass in the superior mediastinum, which compressed the trachea and displaced it posteriorly. The mass in the superior mediastinum proved to be vascular in origin, an aneurysm. The site of origin was not definitely established. The possibilities were an aneurysm arising from the superior portion of the aortic arch, or of the innominate artery, or the left common carotid artery.

Case 4 P.M., a white male, aged 10 years, was referred by the Department of Health for an angiocardigraphic examination because of a large mass in the upper portion of the left pulmonic field observed on fluoroscopic and roentgenographic examination. Previous history revealed a pneumonia in infancy, but was otherwise negative. There was no family history of tuberculosis. The youngster was underdeveloped and complained of dyspnoea on exertion. On physical examination there was observed a depressed sternum. Systolic murmur was heard loudest over the mitral valve. A preliminary roentgen examination of the chest revealed the heart displaced to the left, secondary to the depressed sternum. Attached to the upper portion of the cardiac silhouette was a large extraneous radio-opaque shadow which extended into the upper portion of the left pulmonic field (Fig 5).

A kymographic examination revealed aortic pulsations in the extreme left lateral portion of the extraneous shadow and these were considered as transmitted pulsations. The amplitude of the wave form in the aortic area was larger than that in the extraneous shadow. In the right anterior oblique projection the angiocardigraphic examination showed contrast substance in the right heart, which was enlarged. The aortic arch and descending aorta were visualized. There was no contrast substance in the extraneous shadow. The examination revealed that the extraneous shadow was nonvascular in origin. The possibilities of an atelectasis or agenesis of lung were considered, with the latter receiving preference.

Case 5 W.W., a colored male, aged 12, was referred by Dr. Louis R. Davidson for post operative study. The patient had had a tonsillectomy at about 3 years of age at Kings County Hospital, at which time there was noted a cardiac murmur, and patient was referred to the cardiac clinic of that hospital. His mother stated that she first noted personality changes in the youngster when he was 10 years of age. He was irritable, restless, nervous, and had episodes of depression. He had recurrent episodes of puffiness of his eyelids since that time, and enuresis. In November 1946, patient first showed evidences of dyspnea. He was admitted to Cumberland Hospital in November 1946, and hypertension was

noted in the upper extremities A diagnosis of coarctation of the aorta was made On December 4 1946 he was admitted to Post Graduate Hospital for surgery A transcript from their record revealed the following "Physical examination Chest Breath sounds normal with no rales Heart No arrhythmias were noted, the heart was enlarged to the 5th

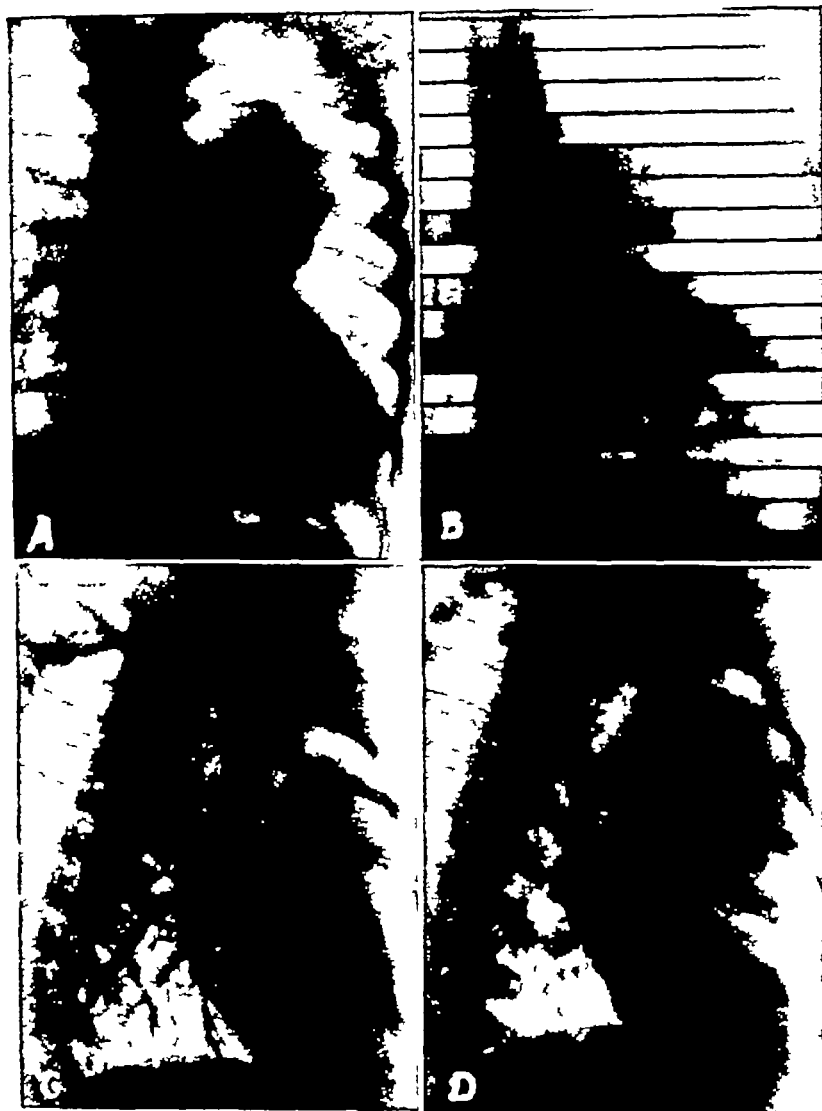


FIGURE 5 CASE No 4 (A) There is a large area of absent aeration of uniform density within the upper half of the left pulmonary field.—(B) Kymographic examination shows transmitted aortic pulsations along the left lateral margin of the density in the upper half of the left pulmonary field.—(C and D) Angiocardiographic examination RAO projection shows no contrast substance in the extraneous density within the upper half of the left pulmonary field

intercostal space and the anterior-axillary line, systolic murmur in the aortic region transmitted to the neck vessels and posteriorly BP right arm 140/70, left arm 110/90, right femoral 94/60, left femoral 90/74 Pulsation of right radial artery was more pronounced than that of the left ECG on 12/9/46 Depressed ST₂, negative T₁, high voltage sinus arrhythmia (this pattern is not diagnostic, but high QRS voltage is suggestive of ventricular hypertrophy) ECG on 12/30/46 Sinus tachycardia, ST₂ not as depressed as previously"

On 12/14/46 an operation was performed The surgeon stated that the preoperative intent was to accomplish an end to end anastomosis after the resection of the coarcted segment of the aorta This was found to be technically unfeasible at the time of operation because the constriction was found to be between the left common carotid and subclavian arteries The subclavian was sectioned near its continuation with the axillary artery and the proximal divided end was anastomosed to the base of the left common carotid Because of the postoperative retention of the left radial pulse, the surgeon was inclined to believe that an enlarged first aortic intercostal rather than the left subclavian was anastomosed at the time of operation The angiocardiographic examination was requested in order to demonstrate or determine which vessel was used for the shunt

Physical examination in Goldwater Memorial Hospital on 1/17/47 revealed BP right arm 178/138, left arm 160/124 Corrigan pulse on the right side Amplitude and force of the right radial pulse was distinctly greater than the left Eyes Tortuosity of the retinal vessels with sclerotic changes described as "copper and silver wire appearance" Marked systolic pulsations visible over the right carotid and right subclavian areas Right hemithorax greater in size than the left Heart apex at the 5th intercostal space There was a systolic thrill and murmur at the 1st, 3rd and 4th right intercostal spaces, parasternally Systolic thrill and murmur over the scapular area on the right side Diastolic murmur over aortic area Operative scar over left scapula No systolic blood pressure readings were obtainable in the femoral arteries On 1/13/47, the day of admission, patient manifested a low-grade pyrexia of unknown origin Subacute bacterial endocarditis was suspected and penicillin administered (There were no other clinical evidences of a subacute bacterial endocarditis) Repeated blood cultures were negative A roentgen examination of the chest revealed a large paratracheal mass, left side Kymographic examination showed aortic pulsations along the left border of the mass (Fig 6)

Angiocardiographic examination in the PA projection made at the end of 4 and 10 seconds revealed the following At the end of 4 seconds, contrast substance was visualized in the right heart, the vessels leading to and from the right heart, and in the lungs At the end of 10 seconds the left heart aorta, large vessels from the aorta, as well as collaterals, were visualized The ascending and proximal half of the transverse portion of the aorta were visualized Two large vessels had their origin in the arch of the aorta, were convex to the left, and extended to the left of the median line these vessels formed the paratracheal mass on the left side, noted above The larger and medial of these two vessels was the innominate artery, and showed its subdivisions for the right carotid and subclavian arteries Arising from the right subclavian was the large, dilated and tortuous internal mammary artery Collaterals along the right axillary chest wall extended from the right axillary

artery down to the level of the diaphragm. The small and lateral vessel was the left common carotid artery, and its course into the neck was visualized. A left subclavian artery was not visualized. No vessels leading to the left arm were visualized. There were no evidences of any collaterals in the axillary portion of the left chest wall.

A second examination in the left anterior oblique projection at the end of 9 and 11 seconds revealed the following. At the end of 9 seconds the left heart was visualized, as well as the ascending and proximal half of the transverse portion of the aortic arch. Here again, the vessels leading to the right side of the neck and right arm were visualized. No vessels with contrast substance leading to the left arm were visualized. The distal transverse portion of the aortic arch and the proximal portion of

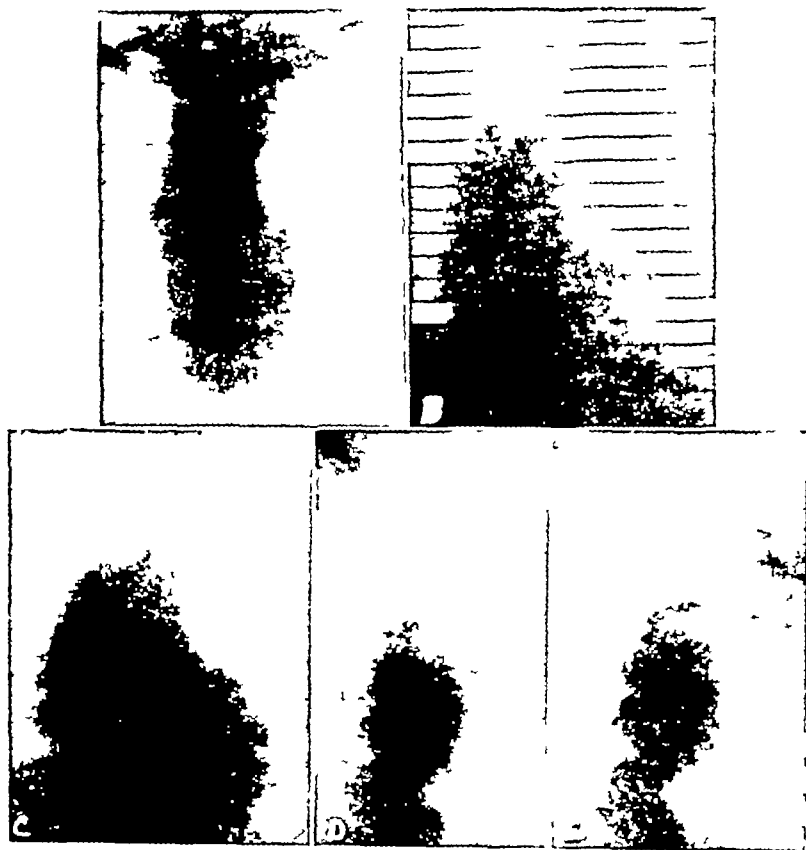


FIGURE 6 CASE No 5 (A) Large mass in the paratracheal area left side — (B) Kymographic examination shows pulsations which are synchronous with the aorta — (C) Angiocardiographic examination reveals that the paratracheal mass on the left side is vascular in origin, and is composed of the left common carotid and innominate arteries. The right internal mammary artery is dilated and tortuous — (D) The left heart, ascending aorta, and the proximal transverse portion of the aorta are visualized. The distal portion of the aortic arch and descending aorta are not visualized — (E) The descending aorta is visualized from the level of the 6th dorsal down. The distal portion of the aortic arch and the proximal portion of the descending aorta are not opacified with contrast substance.

the descending aorta were not visualized. At the end of 11 seconds, the descending aorta was visualized from about the level of the 6th dorsal vertebra down to the 1st lumbar vertebra. At this time, there was very little contrast substance in the left heart and in the proximal portion of the aorta. The examination revealed an absence of a segment of the aorta for a distance of about two inches, namely, the distal transverse portion of the aortic arch, and the proximal descending portion of the thoracic aorta. No vessels containing contrast substance were visualized leading to the left arm.

Comment. There was an anomalous location of the innominate and left common carotid arteries which formed a large paratracheal mass on the left side. There was a dilated, tortuous internal mammary artery, and a collateral circulation along the right axillary chest wall. From the history of the case, as well as the surgery involved, it was obvious that a coarctation existed in the aorta. It was also possible that either a second constricted area was present, or a continuous constriction over a larger area corresponding to the nonvisualized segment of aorta, as described above. The nonvisualization of the internal mammary artery on the left side, as well as the absence of a collateral circulation on the left side, indicated that the vessel used for the shunt at the time of surgery was the one which was responsible for the circulation to the left hemithorax. The shunt was not visualized, nor any vessels leading to the left upper extremity. With the clinical picture in mind, it was my impression that the vessel used for the shunt was a large intercostal, probably the first aortic intercostal (the 3rd intercostal artery). This could account for the absent blood pressure in the lower extremities, the absence of collateral circulation to the left hemithorax, as well as a maintenance of the pulse and elevated blood pressure to the left arm. Because of the anomalous position and development of the innominate and left common carotid arteries, it was assumed that the left subclavian artery did not develop. The blood supply to the left arm which permitted an elevation of the blood pressure, as well as a good pulse in the left arm, was the same after surgery as existed prior to surgery, it was not interfered with by surgery.

SUMMARY

The clinical value of angiocardigraphy for the demonstration of anomalies and the differential diagnosis between vascular and nonvascular mediastinal lesions is presented. Three congenital anomalies are presented through the courtesy of Dr. A. Castellanos. Five case histories are presented illustrating (1) an aneurysm of the arch of the aorta, (2) a localized segmental dilatation in the descending aorta, (3) an aneurysm of the innominate or left carotid artery, (4) a nonvascular lesion, and (5) following surgery for coarctation of the aorta.

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RESUMEN

Se recalca el valor clínico de la angiocardigrafía para demostrar anomalías y se discute el diagnóstico diferencial entre lesiones mediastínicas vasculares y no vasculares. Se presentan tres ano-

malas congénitas, gracias a la cortesía del Dr. A. Castellanos Se presentan tres protocolos que ejemplifican (1) un aneurisma del cayado de la aorta, (2) una dilatación segmentaria localizada de la aorta descendiente, (3) un aneurisma de la arteria anónima o carótida izquierda, (4) una lesión no vascular y (5) un caso subsiguiente a intervención quirúrgica por coartación de la aorta

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Meigs' Syndrome*

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It is a rare privilege for a gynecologist to be invited to address so select a group of specialists whose interests reside chiefly in disorders of the chest. It is likewise exceptional for the gynecologist to be concerned with conditions in the chest other than metastases from pelvic malignancy or tuberculosis. I sincerely appreciate the opportunity afforded me to present a subject of mutual interest by reason of the simultaneous occurrence of hydrothorax and benign pelvic tumors associated with ascites. This is known as Meigs' syndrome, a name first suggested by Rhoads and Terrel in 1937.¹ Although Meigs was the first to recognize and publish the characteristic findings in certain cases of ovarian fibroma in 1937, similar isolated cases—rare indeed—had been reported half a century before. The relationship of peritoneal and pleural transudates to the pelvic tumor was not recognized in these cases, however. Cullingworth² reported a case in 1879 of a benign pelvic tumor, which, at postmortem, was found to be associated with ascites and hydrothorax. Then, in 1892, Lawson Tait³ successfully operated upon a similar case after a long period of observation and unavailing therapy. Ascites associated with pelvic tumors was believed at that time to be indicative of malignancy, and to a great extent that belief prevails today. Tait suggested by implication the more frequent resort to exploratory operation in borderline or suspect cases associated with ascites. He stressed the curability of such tumors. A lapse of about 30 years occurred before the next mention of this interesting set of findings appeared. Hoon of Mayo Clinic published a report of two cases with ovarian fibroma in 1923.⁴ Meigs' first report⁵ of three cases in 1934 was later incorporated in his more complete presentation of seven cases (Meigs and Cass, 1937) which gave rise to the designation of Meigs' syndrome.⁶

While this syndrome is characteristic of certain fibromas of the ovary, Meigs prognosticated correctly in 1939 when he stated "it is possible, therefore, that there are other benign tumorous conditions in the pelvis besides fibroma of the ovary which may be accompanied by ascites and hydrothorax." At the present time,

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Meigs' syndrome embraces any benign tumor of the pelvis which may give rise to ascites and hydrothorax. Case reports since that time reveal that not only ovarian fibromas but fibromyomas, granulosa cell tumors, multilocular cystadenomas, Brenner's tumors, thecomas, fibromyxomas, and even isolated cases of uterine fibromyomata give rise to ascites and associated hydrothorax.⁶

The symptoms of this condition are usually those caused by the hydrothorax and the ascites. The close resemblance to pelvic malignancy with metastases to the peritoneum and pleura often causes it to be misdiagnosed. As Meigs stated, these symptoms are broadly classified into two groups, namely respiratory interference, and abdominal distention. Hence, dyspnea, chest discomfort, cough, and abdominal enlargement may be the earliest findings. In addition, the patient may experience fatigue, backache, upset menses, weight loss, dehydration, emaciation, and even synovitis of the knee.⁷ The syndrome is most commonly found in early menopausal life but may appear at almost any age. In 1943, Herrick, Tyson and Watson⁸ aptly stated that this syndrome must be considered in any female over 30 who shows the presence of hydrothorax if not attended with fever, cachexia or weight loss.

Torsion is not a characteristic of these tumors and Meigs stated in 1943⁹ that "twists of the tumors are rare and adhesions are not common." Yet in the case reported in this paper, and in a fatality reported by Bomze and Kirschbaum¹⁰ torsion was present.

Hoon, in 1923, reporting 55 cases of ovarian fibromas, believed that the ascites, present in 25 per cent of the cases, may have been due to irritation of the peritoneum or to the secretion of a degenerating tumor. Rubin, Novak and Squire¹¹ in a report of 78 cases of thecoma and fibroma, found 30 per cent of the tumors to be accompanied by ascites. Meigs declared the fluid to be typical of a transudate and stated that because of the slight systemic reaction, the fluid was probably a nontuberculous transudate rather than an exudate. The pleural fluid was investigated by a number of workers but in none of the reported cases were tubercle bacilli or other bacteria found.

In Meigs' 1937 report, five patients had fluid in the right pleural cavity, one had fluid in the left, and one had fluid in both sides. This has been true in most of the reported cases, i.e., the fluid is more common in the right chest but may be in the left or in both. In all reported series, the fluid in pleural and peritoneal cavities has been found to accumulate rapidly following thoracocentesis or paracentesis but spontaneously disappeared after surgical removal of the tumor.

Meigs stated the following possibilities concerning the etiology of the ascites and hydrothorax: 1) Irritation of peritoneum by a

hard tumor mass, 2) direct extension from peritoneum to pleura, 3) inflammation, 4) portal obstruction, 5) possible lack of drainage of the right chest by azygos vein. Later Meigs added the possibility of 1) protein deficiency (syndrome occasionally associated with edema of the legs), 2) anatomic connection between the abdomen and chest, 3) torsion or partial rotation of the tumor with twisting of vessels, 4) Selye's alarm reaction in which repeated minor injury to the peritoneum by the tumor builds up the resistance of the tissues which later may return to normal. After many months, continuing trauma negates the resistance and an anaphylactic shock or histamine toxicosis appears which gives rise to the accumulation of peritoneal and pleural transudates. Meigs stated later that the identity of the fluids with respect to all aspects measured (protein concentrate, protein distribution and India Ink concentration) makes probable a fairly free communication between fluid in the chest and abdomen. Clay, Johnson and Samson¹² say, "ascites probably gives rise to hydrothorax via the lymphatics through the interstices of serosal cells under the diaphragm, hence to the subdiaphragmatic lymphatics and so into the chest." It is obvious that the etiology of the fluids is still in the realm of conjecture.

CASE REPORT

Case 1 M O I, age 68, para ii, grav ii. Menses which began at the age of 12 were always regular and continued until the age of 55. No bleeding had occurred since menopause. The patient stated that she had been aware of an enlargement of her abdomen for about five months. However, because she was a Christian Scientist, she deferred seeking medical advice. She was aware of a hard mass in the abdomen and admitted to some dull, dragging pain in the left side. Dyspnea and cough had been present for about one month. The reason for seeking medical advice at this time was an attack of sudden, severe, colicky pain in the left side. This was of a few days' duration when the patient was first seen on July 13, 1945. She believed that her abdomen had swelled more and had become more tender since this acute attack. The remainder of her history was negative. The family history was non-contributory.

Physical examination revealed a very tall, thin, white elderly female with a markedly enlarged abdomen. She showed no apparent distress. There was a definite asthmatic wheeze. Temperature, 99.2°, pulse, 98, respirations, 22, blood pressure, 140/80. Head, neck, eyes, pharynx, and ears were negative. The breasts were atrophic and no masses could be felt. There was no tenderness. A marked wheeze was heard over the upper lung fields but there were no rales. There was a flatness on percussion over the right lung field posteriorly. Breath sounds as well as tactile and vocal fremitus were diminished. The heart showed no abnormality on percussion and no palpable thrill, the heart sounds were of fair quality but irregular, there were no murmurs.

The abdomen was markedly enlarged. A large, smooth, firm mass was palpable extending from just above the pubes to the costal margin.

Some areas in the mass were softer and felt cystic, others were quite hard and smooth. There was a distinct fluid wave in the abdomen. While the abdomen was tense, there was no tympany, and it was remarkably free from tenderness. Reflexes were normal. There was no edema of the extremities.

Pelvic examination revealed a large globular tumor mass which filled the abdomen above the pelvis and which appeared partly cystic and partly solid. The uterus was not entirely palpable and there was bulging of the cul-de-sac.

The impression was that of an ovarian malignancy with acute torsion, ascites, and possible pulmonary metastases.

Because of the emergent nature of symptoms produced by torsion, further studies were deferred and laparotomy was advised.

Supracervical hysterectomy with bilateral salpingo-oophorectomy were done for removal of 1 huge twisted tumor of the left ovary, 2, calcified solid tumor of the right ovary, 3 multiple small fibroids of the uterus, 4, ascites.

Under ethylene anaesthesia, the peritoneal cavity was opened and about two liters of clear straw-colored fluid were removed by suction. The whole peritoneal cavity appeared to be filled by a large cystic tumor which, upon delivery, was found to be twisted on its pedicle 180 degrees. The pedicle was clamped without untwisting and the tumor removed. The right ovary was the site of a solid white tumor the size and shape of an average potato. It was heavy and stony hard. The uterus contained several small fibroids. It was now obvious that all three types of tumors found were benign. The uterus was amputated supracervically, including the right-sided solid tumor. The cervical stump was closed and peritonealized and the abdomen explored further. No evidence of metastases was found in the liver, stomach, omentum or bowel. There was some fibrinous exudate on the small bowel which was adjacent to the twisted tumor. The abdomen was then closed.

Shortly after laparotomy the medical consultant, Dr. William A. Brams, noted dullness of entire right chest anterior and posterior, distant bronchial breathing, few rales. Mediastinum shifted slightly to the right. Cardiac apex displaced to the left. Short systolic, good heart tones. Condition good.

Impression 1 possible massive collapse or 2 massive pleural effusion, right chest.

Notation by Dr. Stein. Calcified fibroma of right ovary was found associated with ascites and hydrothorax, Meigs' Syndrome suggested.

X-ray film of the chest taken the following day revealed the heart and mediastinum displaced to the left, massive pleural effusion on the right. Thoracentesis (Dr. Brams) 1,000 cc dark amber fluid, sent to laboratory for bacteriological and pathological examination, subsequently found to be negative for tubercle bacilli. Repeat thoracentesis, 1,900 cc fluid removed five days later.

July 29 excellent postoperative course. Wound healed by primary intention. Chest clear. No distress. Discharged from the hospital on the 15th postoperative day.

Pathology Report The specimen consisted of a uterus 6 x 6 cm containing multiple small fibromata. Attached were the tubes and a right solid ovarian tumor 6.5 x 3 cm. Separately was a huge cystic tumor, 27 cm in diameter and weighing 6100 gm. The microscopic diagnosis was

- 1 Multilocular serous and pseudomucinous cystadenoma of the left ovary (with torsion)
- 2 Bilateral Brenner tumors of the ovaries
- 3 Myofibromata of the uterus
- 4 Parovarian cysts (See Fig 1)

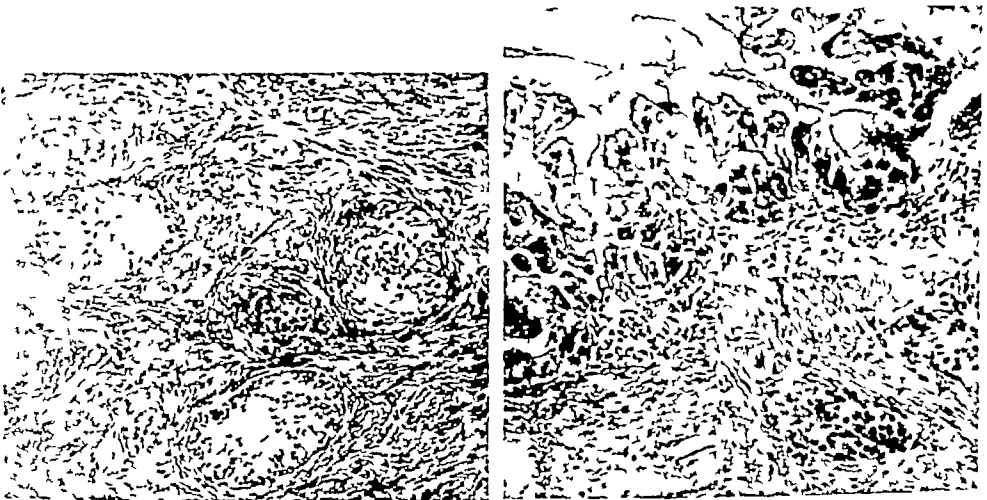
Comment In view of the benign nature of the tumors and the usual course after removal, it is likely that the aspiration of fluid from the chest was unnecessary. It usually disappears spontaneously. However, respiratory embarrassment was relieved by the tapplings and probably recovery was hastened thereby. The patient was seen one month and three months after operation and was found to be in excellent health.

In our opinion, this patient developed Meigs' syndrome in relation to the solid fibroma-like tumor of the right ovary. It may have been caused by one of the following: 1) solid tumor of right ovary, 2) cystadenoma of left ovary, 3) torsion of the large cystic tumor, 4) combination of three separate benign pelvic neoplasms, any one of which might have been the cause of Meigs' syndrome.

The torsion of the large cystic tumor produced the acute symptoms which forced the patient to seek relief. We believe that this episode was incidental to a preexisting Meigs' syndrome.

As far as we can discover, only two cases of Meigs' syndrome have been observed at Michael Reese Hospital in many years. Search of the library index, the pathology department files and inquiry of the gynecologic staff revealed but one additional case to add to the one the author described above. This latter case

FIGURE 1, CASE 1
BILATERAL BRENNER TUMORS



A

B

(A) Fibroma-Like Brenner

(B) Pseudomucinous Cyst Adenoma Brenner Area in inset

was presented as a brief report to the Chicago Gynecological Society at its meeting on May 17, 1946, by Dr Lester E Frankenthal, Jr, and appears in the proceedings of that meeting¹³ Because of the rarity of the condition, I shall present this case in greater detail

CASE REPORT

Case 2 F.P., a 44 year old woman, grav 0, para 0, with a history of normal menses until surgical menopause in 1938, was admitted to the chest service of Dr E Levine at Michael Reese Hospital on March 2, 1946 She complained of dyspnea and abdominal distention which had been present for about two months Her symptoms apparently followed an upper respiratory infection in December, 1945 Since that time, the patient had noted moderate exertional dyspnea In February 1946 the patient became markedly dyspneic without ankle edema, orthopnea, or paroxysmal nocturnal dyspnea She consulted a physician who obtained a chest plate and diagnosed fluid and a mass in the lung Increasing dyspnea caused her to consult another physician who prescribed sedatives On March 1, she was seen by an osteopath who said that in addition to chest fluid, she had an ovarian cyst There was no history of chest pain, cough, hemoptysis or fever

Past history included a mastoidectomy in childhood and a partial hysterectomy in 1938 Her family history was non-contributory

Physical examination revealed a fairly well nourished, pyknic middle-aged, white female, about 45 years old Temperature, 100.2°, pulse, 72, respirations, 18, blood pressure, 128/82 The chest revealed delayed and diminished expansion on the right, absent tactile fremitus, flatness on percussion and distant bronchial breath sounds of the lower two-thirds of the right chest

The abdomen was distended, there was a dullness in the flanks shifting dullness and a questionable fluid wave In the lower abdomen there was a very firm ballotable mass which was outlined with difficulty in view of the abdominal distention

Impression 1, ovarian fibroma with ascites and pleural effusion (Meigs' syndrome) 2, malignancy of pelvic organ with pulmonary metastases

On March 4, 1946, thoracentesis of the right chest was done, and 900 cc of straw-colored fluid was withdrawn, it was negative for tubercle bacilli On March 5, 1946 gynecologic consultation was held and the diagnosis of Meigs' syndrome confirmed The blood counts showed hemoglobin 14.3 grams (85 per cent), red blood count, 5,200,000, white blood count, 8,700 differential normal, sedimentation rate, normal (18 mm./hr) Thoracentesis was performed five times in the next ten days, with the removal of 4,830 cc of clear, straw-colored fluid Fluoroscopy and chest plates obtained on March 8 1946 were negative for parenchymal lung lesions

On March 16, 1946 a *total hysterectomy and bilateral salpingo-oophorectomy* were performed (L E Frankenthal Jr) The peritoneal cavity was opened and a large amount of clear free fluid escaped A large solid tumor of the left ovary, measuring 6 x 12 x 12 cm was found It was globular firm and yellowish-white The pedicle was clamped and cut and the tumor removed The uterus was smaller than normal However, because of the remote possibility of malignancy, a total pan-hyste-

rectomy was done On March 30, fluoroscopy and chest plates revealed fluid in the right lower chest obscuring the right costo-phrenic sinus and cardiophrenic angle On April 6, x-ray film revealed the chest to be essentially negative The patient was discharged in good condition on the 21st postoperative day

Pathology Theca cell tumor of left ovary with degenerative changes and multiple simple cysts (See Fig 2)

Comment

Since the preparation of this report, a complete and valuable article on Meigs' syndrome appeared from the Mayo Clinic¹⁴ with some additional case reports We have added two cases to some thirty authentic cases in the medical literature Obviously, it is a rare but curable condition which is of interest to both the gynecologist and the internist

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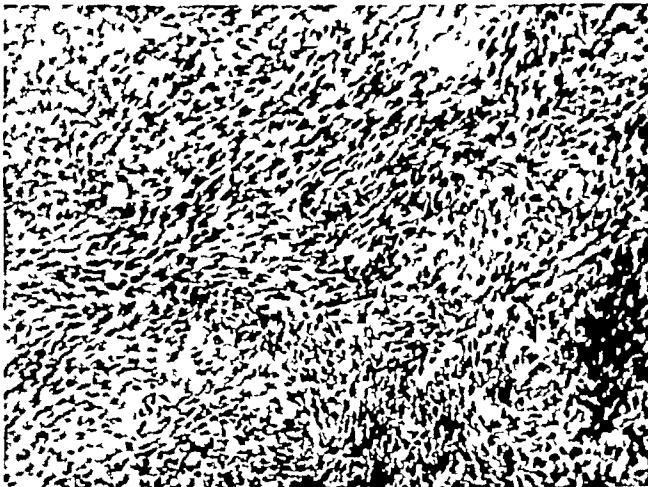


FIGURE 2, Case 2 Thecoma

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D I S C U S S I O N

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Dr Stein has presented a very interesting paper on a condition which is seldom seen by the chest specialist. Rarely seen diseases are easily forgotten, therefore, we are indebted to him for bringing it to our attention. However, this condition may not be as rare as it would seem because more cases are being encountered than are being reported in the literature. I know of five unreported cases in my own town.

In discussing Dr Stein's paper I wish to stress a time honored axiom of medicine namely: Take a complete history and make a complete physical examination. In so doing it will be learned that the symptoms referable to the pelvis and abdomen appear before the symptoms of the hydrothorax occur. The symptoms of respiratory interferences are not necessarily those of malignancy of the pleura or lung. In Meigs' syndrome, streaking, hemorrhage, productive cough, etc., are lacking, therefore, we should assume that in this condition, the respiratory symptoms are due to extrapulmonary etiology. Interpretation of chest films showing hydrothorax should be mentioned. All too often the presence of fluid in the pleural space is taken too casually and at the same time the observer will attempt to diagnose the presence or absence of parenchymal disease in a film with the lung obscured by effusion. The fluid should be aspirated and replaced with a small amount of air before making a diagnosis.

The presence of hydrothorax most often seen on the right side is due to better development of the lymphatic channels on that side, to the higher position of the dome of the diaphragm, and to a more intensive pumping action of the right diaphragm. Rubin, Novak and Squire state that hydrothorax formation is best brought about by an ascitic fluid poor in colloids. It is well recognized

that some pleural surfaces allow fluid to be absorbed more readily than others. If the condition of the pleura prevents absorption of the ascitic fluid, atelectasis may ensue.

I wish, not only to thank Dr Stein for his fine paper, but to express my appreciation for the honor of being allowed to discuss it

D I S C U S S I O N

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Gentlemen, it gives me great pleasure to discuss the fine paper presented by Dr Irving Stein. I have nothing but praise for a clear concise excellent discussion of Meigs' syndrome. I wish to congratulate him on an able presentation and I must also congratulate the program committee for their choice of this important subject.

In the Oxford Monographs of disease and treatment there is nothing mentioned on Meigs' syndrome. The last sentence, however, in the treatment of hydrothorax the following is said: "the treatment of hydrothorax is treatment of the underlying cause." How true this is even in Meigs' syndrome. We chest physicians must bear this in mind. Early diagnosis is important, and early diagnosis can only be possible if the physician is aware of the condition. It is an unusual condition, the occurrence of which bears repetition. It is amazing how unaware this condition is to the medical man unless he has actually been confronted with a patient who has this syndrome.

I have for the past five years looked for such a patient, but with no success. In one patient, in spite of her condition and age, but because of suggestive findings I advised operation for a palpable pelvic mass. The gynecologist, however, on operation found malignancy with widespread metastasis. Patient went steadily down hill and expired. At another hospital I had anticipated finding Meigs' syndrome on several occasions. In spite of suggestive findings in the chest (fluid, apparently not tuberculosis) we were unable to establish a diagnosis of Meigs' syndrome.

I am pleased to report very briefly on a patient who was under the care of a personal physician friend (Dr David Katz, July 1943). This patient, 69 years of age, white, had all the characteristic findings: 1) Enlargement of the abdomen 2) Pelvic mass 3) Fluid in the chest and abdomen. After five aspirations (totalling over 6,000 cc) of the chest and after continued study the patient's

condition was not satisfactory. Finally, however, in desperation the patient was operated upon and a fibroma of the ovary was removed. She showed remarkable recovery and after the third postoperative day progress was rapid and she soon became physically and clinically well.

The failure to diagnose Meigs' syndrome is serious. Team work between the gynecologist and internist is important. If the gynecologist is not aware of this possibility, he will consider the pelvic mass with fluid in the abdomen and chest as indications of widespread metastasis. To the clinician Meigs' syndrome must be considered in the differential diagnosis of fluid in the pleural cavity in all female patients.

I enjoyed Dr. Stein's presentation and wish to thank the members of the College and guests for the privilege of discussing this paper.

The Rationale of Therapeutic Pneumoperitoneum

Physiological and Mechanical Considerations*

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A priori reasoning has in the past convinced many chest physicians that the therapeutic approach to pulmonary tuberculosis by the abdominal route with artificial pneumoperitoneum is unscientific, unsound physiologically, and radical. Indeed, to treat thoracic disease by the injection of air into the peritoneal space seemed at the onset so formidable and ridiculous that some physicians have been reluctant to abandon established methods of collapse therapy. Other physicians unfortunately have attempted to use this form of therapy in a few unselected, far-advanced cases, neither mastering the technique nor really understanding the rationale behind its use. Their results quite naturally, have been disappointing.

Other groups of courageous phthisiotherapists have succeeded in demonstrating the favorable therapeutic influence of pneumoperitoneum by extensive and prolonged experience with this technically simple and relatively safe procedure. Their results have been, for the most part, remarkable, indicating that artificial pneumoperitoneum is perhaps as effective a collapse measure as artificial pneumothorax and at the same time, apparently much safer. The advantages of this form of therapy over artificial pneumothorax have been discussed in a previous paper.¹

The discrepancy between the dangerous anti-pneumoperitoneum reasoning mentioned above and the surprisingly favorable results may be clarified by examining carefully the reasons for the effectiveness of artificial pneumoperitoneum. It is the purpose of this paper to attempt to explain just why artificial pneumoperitoneum benefits pulmonary tuberculosis.

The Peritoneal Space

The peritoneal space is, ordinarily speaking, a closed one that is the flexible and cohesive nature of the abdominal wall, of the viscera, and of the moist serous surfaces of the peritoneum and omentum results, for the most part, in an absence of dead space. This absence of dead space not only is further effected by the tonus of the abdominal muscles, but also by the slightly sub-

*Presented at the Thirteenth Annual Meeting, American College of Chest Physicians, Atlantic City, New Jersey, June 5, 1947.

atmospheric pressure present in the upper abdominal cavity resulting presumably from the negative pressure existing in the adjacent intrapleural spaces. If these concepts of intraabdominal mechanics can be visualized, then the rationale of artificial pneumoperitoneum becomes much clearer.

That there is a negative or subatmospheric pressure present in the upper abdominal cavity has been indicated by Keppich,² Melchior,³ Krause,⁴ and Overholt,⁵ and thoroughly discussed by Banyai⁶ who has pioneered and championed artificial pneumoperitoneum therapy. The subject becomes more complicated when one considers the variations of this subatmospheric pressure under the influences of respirations, disease, adhesions, muscular activity, and of the ever-changing mobility of the abdominal viscera.

Nevertheless, for the purposes of this discussion, we shall postulate that the rigid compartment of the thorax transmits to some degree the subatmospheric pressure of the intrapleural space subdiaphragmatically into the non-rigid structures of the abdomen. Conversely, a change in the existing intraperitoneal pressure is directly transmitted to the lower pressures of the intrapleural space and consequently to the lungs. This is apparently what takes place when, for example, 500 cc of air is introduced intraperitoneally. The increased pressure is immediately transmitted partially to the thorax, and the lungs, being readily collapsible, are reduced correspondingly in volume. Because of the existing negative intrapleural pressure and the collapsibility of the lungs, the majority of displacement takes place in the direction of the lungs rather than toward the rigid pelvis or toward the less-rigid, but muscular abdominal wall. This occurs with the patient recumbent or standing since the points of least resistance remain the same.

Thus it is seen that, after one injection of intraperitoneal air, the diaphragm will rise nearly two centimeters at the expense of lung volume. This reduction of lung volume often results in an immediate therapeutic benefit after a single injection of air. This may be partially explained by the resulting relaxation of the lung, improved bronchial drainage from diseased areas, and by reduction of toxemia following closure of lymphatic vessels communicating with diseased areas.

EXPERIMENTAL

The Pleural Space

After a intraperitoneal injection of air what happens to the intrapleural pressure? It is increased! This has been shown to be invariable in six cases by simultaneous measurement of intra-

pleural pressure with a pneumothorax needle in the intrapleural space during the administration of artificial pneumoperitoneum with a separate apparatus

This intrapleural pressure does not *remain* increased. By the time another intraperitoneal injection of air becomes due, the intrapleural space pressure has decreased practically to its normal state despite the fact that the lung volume remains reduced. The mechanism of this compensatory reaction is obscure. The fact that this pressure does return to a nearly normal subatmospheric state indicates that the thorax is prepared for an identical response to later intraperitoneal injections of air. Consequently each successive dose of pneumoperitoneum is simply another step in progressive and continued relaxation of the lungs and reduction of lung volume. Thus, in long-standing pneumoperitoneum, the intrapleural space, instead of building up a high pressure as a result of continued pressure from below, actually *remains in an almost normally functioning physiological state*.

That this temporarily increased intrapleural pressure returns to practically its normal state has also been repeatedly indicated in six patients by actual measurement of intrapleural pressures during the course of established pneumoperitoneum treatment. Herein lie two of the most important factors which explain the success of pneumoperitoneum: one, the initial rise of intrapleural pressure following intraperitoneal injection of air, and two, the rapid return to a nearly normal physiological state. These phenomena help explain why both functioning lungs may be partially and progressively collapsed over long periods of time while the healing process takes place. They also indicate that the mechanics and physiology of the intrapleural spaces are altered very little over a period of pneumoperitoneum therapy. Following cessation of refills, the intrapleural spaces are left essentially unaltered. This of course is not the case in long-standing artificial pneumothorax where the pleurae are invariably thickened, thus resulting in impairment of respiratory function.

The same reasoning explains partially why cases with adherent pleurae respond *less* satisfactorily to artificial pneumoperitoneum. In these cases lung volumes reduce with more difficulty, and higher intraperitoneal pressures must be attained before comparable rises of the diaphragm are achieved. Therefore, one of the indications for perfect suitability of a case for pneumoperitoneum therapy is the integrity of the intrapleural space. Unfortunately many cases come to this therapy when pneumothorax has failed or cannot be given because of adherent pleurae. Even so, many of them are benefited by the pneumoperitoneum.

It must not be forgotten that it may in some cases be necessary to

give maximum injections of air in order to overcome the resilience of the muscular diaphragm, thus achieving a maximum therapeutic response which is apparently related significantly to reduction of lung volume

The Lungs

It has been shown¹ that apical disease responds as favorably to artificial pneumoperitoneum as disease elsewhere in the lung. When one considers that pressure changes in uncomplicated cases should be transmitted equally to all parts of the closed space in the thorax, it is readily understood why apical cavities close. Another factor is that the lung is cone-shaped and it is quite possible that pressure changes from below may be augmented as they are transmitted to the smaller apex. Actually, this may be a prominent factor in the healing of apical tuberculosis following strict bed rest taken flat without a pillow, with the foot of the bed elevated, or with the patient wearing an abdominal binder.

The healing of hilar tuberculous infiltrations and cavities is usually a more difficult achievement for any form of collapse therapy. This may be partly a result of the increased rigidity of the larger bronchi and blood vessels in that area, which thus prevents easy collapse. The author feels that another important factor is the proximity to the hilar area of the constantly pulsating great vessels and heart, a situation which precludes any chance of constant immobilization. These rhythmic pulsations of the heart and larger vessels in the hilar area exert a constant massaging action on the closely surrounding lung tissues which, if tuberculous, have diminished chances for healing.

The Diaphragm

The addition to pneumoperitoneum therapy of phrenic nerve crushes unquestionably results in further elevation of the diaphragm and increased collapse of the lung on the relaxed side. Furthermore, following phrenic nerve crushes, patients often seem to tolerate refills of pneumoperitoneum more comfortably. Nevertheless, phrenic nerve crushes result in altered respiratory function, and occasionally paralyzed diaphragms fail to regain normal contractility following cessation of pneumoperitoneum therapy. Phrenic nerve crushes, although often required, are therefore not necessarily considered to be a favorable adjunct to pneumoperitoneum therapy.

Abdominal Binders

The effect of abdominal binders or corsets used during the treatment of pulmonary tuberculosis with artificial pneumoperitoneum seems to be manifold. In addition to the reduction of

cosmetic inelegance resulting from a protuberant abdomen, there seems to be a soothing effect on the abdominal musculature which bears much of the burden of increased abdominal pressure. Furthermore, several days following refills of air, the diaphragmatic elevation may be maintained by tightening the binder as the air is absorbed. This results not only in a continuous elevation of the diaphragm but also in an increase in the time interval between refills. That pressures will rise and further elevation of the diaphragm can be effected by the use of abdominal binders is readily proved by comparing intraperitoneal pressures with and without a binder and comparing by fluoroscopy the elevation of the diaphragm. Nevertheless, abdominal binders are unnecessary in most patients.

Vital Capacity

Further observations of physiological alterations during pneumoperitoneum therapy indicate that the vital capacity is ordinarily diminished much less than would be expected considering the reduction in lung volume. Both Banyar⁷ and Bennett⁸ recorded an average decrease of twelve per cent in vital capacity in established cases. Our experience parallels these findings although in some cases the vital capacity may actually be increased. The simplest explanation of this is that the more diseased and non-functioning lung areas are collapsed selectively, leaving healthy alveoli more space to function. There are doubtless other factors, however, which mediate toward altered respiratory function. These factors include displacement of the diaphragm and mediastinum, as well as lateral displacement of the heart which may result in reduced cardiac reserve. Electrocardiographic studies by Benatt and Berg⁹ have shown that the normal tracing develops a Q₃T₃ pattern and the S-T deflection in Lead II becomes flattened. No signs of coronary thrombosis or pulmonary embolism have been noted. The pattern is apparently reversible and becomes normal again with the descent of the diaphragm. Most of the changes are secondary to an anti-clockwise rotation. These authors conclude that in general pneumoperitoneum treatment in a tuberculous patient with a normal heart does not entail any damaging cardiovascular changes.

Weight

The question of weight gain or loss has been a perplexing one. Many of our far-advanced cases treated with pneumoperitoneum gain as much as forty pounds during the healing process. A minority, however, in spite of marked improvement of their tuberculosis, parallel bilateral pneumothorax cases by failing to gain weight. Now why should some healing patients gain and others

lose weight during the course of identical treatment?

We have tried to show roentgenographically in six patients, by means of the barium meal, that some do not gain weight because of regurgitation of food, or from anorexia resulting from diaphragmatic herniation or because of unnatural tension and torsion of the esophagus. This has been impossible to prove since all cases examined were normal in every respect with the exception of one which exhibited mild cardiospasm.

All cases, however, both those that gained weight and those that did not, were shown by the barium meal to have visceroptosis. The stomachs for the most part were downwardly and centrally displaced into the pelvis. Since this visceroptosis was present in both types of patients, it was not thought to be primarily responsible for lack of weight gain in a minority.

A clue was uncovered by the measurement of vital capacity changes in patients before and after therapy was begun. Those cases which failed to gain weight usually belonged to the minority group which exhibited marked lowering of vital capacity. Apparently the reduction of respiratory exchange is partially responsible for impaired metabolism and nutrition.

Another attendant observation was that patients with adherent pleurae—those that required higher pressures to achieve therapeutic responses—had more difficulty in gaining weight. This could also be partially explained by reduction in vital capacity resulting from the adherent pleurae.

SUMMARY

1) An attempt has been made to clarify some of the physiological and mechanical changes resulting from artificial pneumoperitoneum.

2) The rationale of successful artificial pneumoperitoneum therapy is discussed.

3) Two salient factors appear to be (1) the initial rise of intrapleural pressure resulting from intraperitoneal injection of air, and (2) the compensatory return of the intrapleural pressure to normal between refills.

4) The response of apical disease to this therapy is considered in contrast to disease elsewhere in the lungs.

5) The role of phrenic nerve crush as an adjunct to pneumoperitoneum therapy is briefly considered.

6) Abdominal binders are evaluated.

7) Vital capacity and cardiac changes during artificial pneumoperitoneum therapy are discussed.

8) Some of the reasons for weight gain and weight loss during this therapy are presented.

In many institutions for the tuberculous, artificial pneumoperitoneum has become a recognized method of collapse therapy. Contrary to considered medical judgement regarding possible harmful physiological changes resulting from its use, it has been shown that the complications and physiological alterations resulting from this therapy are by no means as serious as anticipated.

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RESUMEN

1) Se ha intentado aclarar algunas de las alteraciones fisiológicas y mecánicas que siguen al neumoperitoneo artificial.

2) Se discute la razón lógica de la neumoperitoneoterapia artificial satisfactoria.

3) Los dos factores sobresalientes parecen ser (1) la elevación inicial de la presión intrapleurar causada por la inyección intraperitoneal de aire y (2) la vuelta compensatoria de la presión intrapleurar a lo normal, entre las insuflaciones.

4) Se considera la respuesta a esta terapia de las lesiones apicales, en contraste a las lesiones de otras partes de los pulmones.

5) Se considera sucintamente el papel de la trituración del frénico como adjunto a la neumoperitoneoterapia.

6) Se avalúa el empleo de fajas abdominales.

7) Se discuten las alteraciones de la capacidad vital y del corazón durante la neumoperitoneoterapia artificial.

8) Se presentan algunas de las razones que explican los aumentos y las pérdidas de peso durante esta terapia.

El neumoperitoneo artificial ha llegado a ser un método reconocido de colapsoterapia en muchas instituciones para tuberculosos. Contrario a la creencia de que cambios fisiológicos perjudiciales pueden resultar con su empleo, se ha demostrado que las complicaciones y alteraciones fisiológicas que siguen a esta terapia no son ni por mucho tan graves como se había supuesto.

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The Tuberculin Test A Vital Factor in Tuberculosis Control

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Any procedure that helps find cases of tuberculosis, and particularly if such cases can be diagnosed relatively early, assumes a very important role in the campaign for the reduction in the incidence of clinical tuberculosis, and the eventual eradication of this serious menace to the public health. Of the various methods used in the discovery of early tuberculosis, the Mantoux tuberculin skin test is one of the most accurate and dependable diagnostic procedures available to the clinician and the public health worker.

The first requisite for the development of tuberculosis in the human body is an invasion of the body tissues by the tubercle bacillus, and the tuberculin skin test is the earliest and most accurate means of demonstrating that such an infection has occurred. Thus, by use of the tuberculin skin test, tuberculosis in its earliest stages—preclinical stage in many cases—can be found and the patient, in most instances, enabled to avoid the actual development of clinical or active disease.

The Mantoux tuberculin test is extremely selective in its ability to indicate those individuals who have become infected by tubercle bacilli, and thus these positive reactors can be known and suitable precautions against the possible occurrence of active tuberculous disease be taken before any serious menace to the patients' health has developed. If the presence of tuberculous infection in these individuals is not known *early*, then an appreciable number of these people will eventually develop active, open tuberculosis, thus jeopardizing their own health and also becoming a serious "spreader" of tuberculous infection to a varying number of relatives, fellow-workmen, or others who may be in relatively close contact with one who has active tuberculosis with tubercle bacilli in the sputum.

Since the tuberculin skin test is decidedly selective, or pathognomonic, it assumes important value as a means of differential diagnosis between tuberculosis and other pathological conditions, such as histoplasmosis and others, that may closely resemble tuberculosis in clinical aspects, x-ray findings, or both. It is here that a *negative* tuberculin skin test assumes great importance and value.

The tuberculin skin test is a very simple, and a relatively inexpensive method of educating the general public in the fundamentals of tuberculosis prevention as well as being the first step in making a definite diagnosis of tuberculosis in the earliest stages of the disease. This method of approach to the important public health problem of tuberculosis prevention and case-finding is especially applicable among *young* people such as boys and girls of the Junior High and Senior High School age group, young men and women in our colleges and universities, and young adults in general. The tuberculin test is also important and valuable when employed as the initial step in the examination of infants and young children who have been in contact with tuberculosis or who may have suspicious symptoms of actual disease.

In order to make a tuberculin testing program effective, it should be repeated at regular intervals in order that those individuals who were negative at the time of previous tests may be retested to determine if they have become infected with tubercle bacilli at a later date. In rural counties the tuberculin tests should be repeated at least every two years and annual testing is desirable if personnel and facilities for doing the tests are available. Among special groups, such as college and university students, people living in districts where the incidence of tuberculosis is high, "tuberculosis contacts," etc., tests should be repeated more frequently.

Where it is possible to use the two-dose method of intracutaneous testing, as in colleges and universities, this method is preferable and the most accurate and dependable way of finding *all* of the positive reactors in the group. For routine single-dose testing, as in Junior High and Senior High School groups, the author considers an intermediate dose of P.P.D.—ten times the first strength, or a dosage of 0002 mg—as a very satisfactory strength of P.P.D. to use. P.P.D. in this dilution (0002 mg), should miss very few of the significant reactors, if the testing material used is freshly made up and the technique of doing the test itself is properly followed. I feel that a word of warning is in order in regard to the use of *large* doses of either P.P.D. or Old Tuberculin in making skin tests. I am convinced that an appreciable number of false-positive reactions may occur where relatively large numbers of individuals are tested and rather large doses of P.P.D. (005 mg) or Old Tuberculin in dilutions of 1 to 100 or 1 to 10, are employed.

It is customary to read the tuberculin skin tests at about 48 hours after the time the tests were made, but it likely is true that 72 hours is a better time at which to read the tests. This is true for two important reasons: first, that false reactions of a temporary nature have additional time in which to disappear, and

secondly, the few delayed reactions, which often are encountered in testing relatively large numbers of individuals, have that much more time in which to become evident

I have purposely tried to present some of the reasons why this simple procedure should be employed by an increasing number of physicians in general medical practice and by public health workers as a means of finding individuals who have been infected by tubercle bacilli, and consequently, are potential cases of clinical tuberculosis. It is the simplest and easiest step in locating possible cases of tuberculosis, can be cheaply and readily done, and if positive, serves as a "lead" for further investigation and examination.

Concerning this subject Sweany¹ writes "As time passed, tuberculin testing became a preliminary screening device in case-finding surveys, especially in schools and colleges. Dozens of studies, including tens of thousands of tests, were reported. In some instances enthusiastic workers tended to overemphasize the value of the tuberculin reaction. However, certain significant conclusions could be drawn. A positive reaction was proved to be a literal "game trail" of the first significant sign of the tubercle bacillus. Tuberculin testing was found useful in locating tuberculous foci in family circles by following the reactors in school surveys to their homes. In the practice of medicine, especially in pediatrics,

TABLE I
Summary of Tuberculin Tests
September, 1931 to June, 1939 — State of Washington

Sept, 1931 to June, 1938		Sept 1938 to June, 1939		Total Tests	Total Positive	Per cent Positive
Tests	Positive	Tests	Positive			
*Junior High and Grades						
21,182	1,932	5 087	299	26,269	2,231	8.5
*Senior High School						
33 120	4,246	6 003	660	39,123	4,906	12.5
College Students						
2 661	586	684	135	3,345	721	21.6
Teachers						
2,631	1 054	397	138	3,028	1 192	39.4
Extras (Adults Contacts, etc.)						
2 711	927	572	205	3,283	1,132	34.5
62 305	8 745	12,743	1,437	75,048	10,182	13.6

*No city children included. No tests done in Seattle, Tacoma or Spokane. The great majority of these tests were done with Old Tuberculin, in a dilution of 1 to 1,000. The author started using P.P.D. about 1940.

it was helpful in diagnosis of obscure conditions, in finding tuberculosis in older age groups in communities where the infection rate is low, and in ruling out nontuberculous pulmonary conditions. Finally, apart from its diagnostic value, it made a significant contribution to the field of public health education by focusing attention upon tuberculosis.

"With the various possibilities in mind, it is obvious that there are far greater opportunities for use of the tuberculin reaction than is commonly appreciated. While it may fall far short of a diagnostic agent to detect 'clinically active' tuberculosis, the reaction rates high in the scale of useful methods in the diagnosis of chest diseases. It deserves to be the first procedure after history, physical, x-ray and sputum examination. In fact, it should be

TABLE II
Summary of Tuberculin Tests
September, 1943 to April, 1945 — State of Kansas

	Sept, 1943 to Apr, 1944		Sept, 1944 to Apr, 1945		Combined Totals		Per cent Positive
	Tests	Positive	Tests	Positive	Tests	Positive	
Under 6 years	394	1	222	5	616	6	0.97
6 years old	883	4	507	5	1,390	9	0.64
7 " "	890	12	562	6	1,452	18	1.23
8 " "	890	17	567	6	1,457	23	1.57
9 " "	976	14	681	12	1,657	26	1.56
10 " "	1,012	26	763	13	1,775	39	2.19
11 " "	1,270	32	929	21	2,199	53	2.41
12 " "	2,204	67	1,852	38	4,056	105	2.58
13 " "	2,586	77	2,270	41	4,856	118	2.43
14 " "	2,545	67	2,259	57	4,804	124	2.58
15 " "	2,488	82	2,156	69	4,644	151	3.25
16 " "	2,320	98	1,951	62	4,271	160	3.74
17 " "	1,730	75	1,492	61	3,222	136	4.22
18 " "	379	16	217	12	596	28	4.69
Adults	1,518	256	1,355	229	2,873	485	16.88
Unclassified	633	26	275	14	908	40	4.40
TOTALS	22,718	870	18,058	651	40,776	1,521	3.73

Tests done with PPD (ten times the first strength dose), using single test only.

Tests done in forty-five different counties during the two-year period. The great majority of the tests were done in rural counties. No tests done in Topeka, Wichita or Kansas City, Kansas.

simultaneous with the other studies in all patients with negative sputum. It may be stated without reservation that tuberculosis is the principal disease to detect or eliminate in chest work and the quantitative tuberculin reaction is one of the most valuable aids in the achievement of this result."

Canuteson² stated "We are just completing a summary of our tuberculin testing for the fall semester of this year (1947-48) at the University of Kansas. The further I go into the matter of tuberculin testing and x-raying as case-finding procedures the more I believe that the tuberculin, for our purpose, is the first method of choice. I can readily grant that in a different type of population where the controls over the group are much less than they are here the mass photofluorography would be more convenient."

From the Sixteenth Annual Report of the Tuberculosis Committee, American Student Health Association,³ for the Academic Year, 1945-46, the following notes deserve attention: "The committee continues to recommend the use of the tuberculin test as the ideal screening method for a tuberculosis control program. Preferably, this test is accomplished with Purified Protein Derivative of tuberculin (P.P.D.) given in two strengths by the method of Mantoux. It has long been recognized that many colleges have difficulty in fitting this ideal method into the structure of their health service program. The tuberculosis control program recommended by this committee includes, in addition to the initial testing of all students and x-ray of reactors, the annual repetition of the test on all previous non-reactors and annual x-ray for all

TABLE III

	Tests done in October, 1944		Tests done in January, 1946	
	Tests	Positive	Tests	Positive
12 years old	32	1	28	2
13 " "	39	0	37	2
14 " "	37	4	47	4
15 " "	45	0	42	8
16 " "	25	1	39	6
17 " "	18	1	26	6
18 " "	0	0	2	0
TOTALS	196	7 (3.57%)	221	28 (12.7%)

The increase in positive reactors in this group of pupils—almost a ten per cent increase over a period of fifteen months—demonstrates one of the reasons why tuberculin testing should be repeated in high schools at least every two years or more often if convenient to have the tests done

reactors Only thus will the maximum number of cases of tuberculosis be discovered at the earliest possible time Likewise, only then shall we be able to demonstrate the maximum number of students with the germ of tuberculosis "

The following tables illustrate some of the findings in doing rather large numbers of tuberculin (Mantoux) tests in rural and semi-rural communities in the State of Washington and in Kansas

Table I shows two rather significant things First, the fact that the percentage of positive reactors is rather large for tests done in rural and semi-rural counties in the State of Washington, and second, the very definite increase in the percentage of reactors as the age of the various groups increases It is quite true, of course, that the percentage of positive reactors, among most groups of the population in the United States was a great deal higher fifteen years ago than at the present time

Table II shows that the percentage of reactors in rural communities in Kansas and during the later period of 1943-45 is very much reduced as compared with those of the earlier period Another interesting point is the almost uniform increase in the percentage of reactors with increase in age

Table III shows the effect of the development of an active, open case of tuberculosis in a school These tests were done in a medium-sized High School in a town of about 3,500 population Quite a large percentage of those tested in January 1946 were the same pupils that had been previously tested in October 1944 In the meantime, a teacher in this school had developed an active case of pulmonary tuberculosis

The more than 115,000 tuberculin skin tests summarized in the two tables were all done and read by the author, so there was uniformity in procedure, both in the method of doing the tests and the standards of interpretation

SUMMARY

The foregoing is presented solely with the idea in mind of emphasizing the importance and value of the tuberculin skin test as one of the valuable "tools" in our efforts to educate the general public in preventive measures against tuberculosis, and also as a definite and dependable part of the routine examination of patients who may be suspected of having tuberculous disease In the effort to make a definite diagnosis, and particularly in the case of tuberculosis, to arrive at a diagnosis as *early* as possible, all methods of proven worth and value should be employed In this connection the author feels that the tuberculin skin test is a very practical, valuable and worthwhile procedure

RESUMEN

Se ha presentado lo anterior con el único propósito de recalcar la importancia y el valor de la prueba cutánea a la tuberculina como uno de los instrumentos valiosos en nuestros esfuerzos de educar al público en general en las medidas preventivas contra la tuberculosis y, también, como parte bien definida y confiable del examen sistemático de pacientes que se sospeche que puedan tener tuberculosis. En el esfuerzo de hacer un diagnóstico bien definido y, particularmente en el caso de la tuberculosis, para hacer el diagnóstico tan temprano como lo sea posible, se deben emplear todos los métodos de mérito y valor comprobados. En este sentido el autor opina que la prueba cutánea a la tuberculina es un procedimiento muy práctico, valioso y meritorio.

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Medical Aspects of Rehabilitation in Tuberculosis*

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A Pathological and Immunological Basis for Rehabilitation

The average patient with tuberculosis takes active treatment for a period of one to two years, and is discharged as apparently arrested several months after his sputum has become negative and he has become symptom free. There are two questions which must confront the physician when this point is reached. The first is what is the actual residual disease in the lung of this patient whose lesion appears by x-ray to have resolved or to have undergone fibrosis. The second is what is the immunological status of the patient with respect to the residual infection in his body.

In answer to the first question it may be said that the course of reinfection tuberculosis is modified by the indeterminable factors, native immunity, degree of allergy, the dose as well as the virulence of invading organisms, and many other factors more difficult to evaluate. There are consequently extreme variations in the rate of progress of the disease as well as in its rate of healing. The careful studies of healing and resolution cited below preclude any assumption that a patient discharged from the sanatorium with the usual criteria of an apparently arrested case can conceivably be cured and out of danger. The studies of Sweaney¹² show that the average rate of encapsulation and resolution in both primary and reinfection tubercles of moderate size (3-12 mm) is a relatively uniform function of time over a period of ten to twenty years. Amberson¹ summarizing his observations in several thousand cases states as follows:

"Clinical observation suggests that competent encapsulation requires a year or two and sometimes more after resolution has exhausted its role, a point needing strict attention in attempting to guard against relapse."

Cases are presented by Amberson¹ and by Pinner⁸ to demonstrate the fact that tracing a fading lesion to the point of invisibility by x-ray films does not prove its actual disappearance. The presence of caseation over many years' duration is demon-

*From the Rutland Training Center, Rutland, Massachusetts. Presented at the 13th Annual Meeting, American College of Chest Physicians, Atlantic City, New Jersey, June 5, 1947.

strated by the appearance of calcification after a lapse of five to ten years during which time the x-ray has been clear. Experimentally similar discrepancies between roentgenological and anatomical evidence of disease in rabbits infected with tubercle bacilli have been demonstrated by Austrian and Willis² and by Burke³

The above teachings constitute the basis for the customary vigilance toward the discharged sanatorium patient. We recognize that describing him as arrested furnishes a clinical picture of his disease, that anatomical changes are still in progress, and will continue to be for years to come. The frequent flare ups are understandable in the light of this knowledge.

Faced with the problem of guiding a patient with residual infection, the answer to the second question is highly desirable. What is the immunological status of the patient with respect to his infection? The problem here is similar to that in the handling of an acute infection such as lobar pneumonia. In the days before the advent of chemotherapy a crisis or lysis indicated the establishment of immunity in the patient, and the disease was known to be under control from this point on. With the use of antibiotics remarkable cures were established within a few days. It was a common experience for those who discontinued the use of drugs upon the first x-ray evidence that the lung had cleared to find within two or three days that the disease had returned in the same or in another lobe. The obvious explanation was that treatment had been discontinued prematurely—before the establishment of adequate immune mechanisms on the part of the body. Minute areas of residual disease were therefore capable of serving as centers from which renewed attacks upon a defenseless body take place.

The immunological mechanisms in tuberculosis are infinitely more complex than those in lobar pneumonia although they may be similar in basic pattern. Some insight into this complexity may be gained from Rich's detailed discussions.⁹ It is obvious from the clinical course of this chronic infectious disease that the defense mechanisms are developed slowly, and do not attain their maximum height until several years after the onset of the infection. Furthermore, marked fluctuations in the level of immunity occur constantly under the influence of factors such as pregnancy, the puerperium, fatigue, emotional strain, and many others. Under the circumstances it becomes virtually impossible in any individual patient, discharged as arrested from a sanatorium, to predict to what degree he will withstand the various untoward influences upon his immune level. Knowing full well that viable organisms are probably still present, no matter how clear the x-ray film, the uncertain immunological state here, as



Figure 3



Figure 2



Figure 1

is the case after two or three days of chemotherapy in lobar pneumonia, demands the continuation of treatment. It is for this reason that we look upon the process of rehabilitation in tuberculosis primarily as the continuation of medical treatment during a period of increased activity when sociological and psychological readjustment can be brought about.

To demonstrate the importance of the immunological status in the course of pulmonary tuberculosis in patients discharged as arrested from sanatoria, two cases are presented below. In each the total area of visible disease was extirpated by surgery, and no roentgenological evidence of residual disease remained.

Case 1 H.P. was a 31 year old housewife admitted to the sanatorium two months after the onset of symptoms. Her admission film (Fig. 1) shows her disease limited to a shrunken right upper lobe. Her white blood count was normal and sedimentation rate was 2.23 mm per minute (Rourke method. Upper limit or normal 4). Sputum was positive. Pneumothorax was instituted on the right six weeks after admission. The right upper lobe became completely airless and shrunken (Fig. 2). Bronchoscopy substantiated the impression of intrabronchial disease. The patient gained considerable weight. Her blood smear showed a rise in lymphocytes from 10 to 20 per cent and the sedimentation rate dropped to 142. The sputum, however, remained positive on culture. Therefore, a right upper lobectomy was carried out on July 9, 1942, eleven months after admission. A right temporary phrenic paralysis was also carried out in order to reduce the size of the pleural cavity on this side. The patient was allowed up and about one month after operation, discharged less than three months after her operation as apparently arrested. On discharge no evidence of disease could be seen anywhere in the lung. The patient was under the impression that she was completely cured by her surgical procedure and she returned to full time activity within a few months after discharge. Two years and seven months after discharge the patient suffered a miscarriage. At that time a slight cough was followed by a small hemoptysis, and an x-ray showed a large new area of infiltration opposite the anterior end of the second rib (Fig. 3).

Case 2 E.T.W. was a twenty-three year old single girl, admitted to the sanatorium on March 9, 1943 with minimal disease in the right upper lobe (Fig. 4). A single gastric lavage was found positive on guinea pig inoculation. Pneumothorax was begun on the right side eight months after admission because of the failure of the lesion to clear on a regime of bed rest. The appearance of the collapsed lung is seen in figure 5 where a solitary nodule can be seen at the level of the mid portion of the second right interspace anteriorly. Because this area remained uninfluenced by the collapse therapy, resection of the right upper lobe was carried out in her fifteenth month. Six months later she was discharged to a program of rehabilitation at the Rutland Training Center. On admission to this institution her x-ray was clear. She was completely symptom free and her blood was normal with respect to white count, smear and sedimentation rate. Although placed on a regime of graduated increasing activity this girl was at all times under the impression



Figure 6



Figure 5



Figure 4



that she had been completely cured by virtue of the fact that her disease had been completely removed. It was found impossible, therefore, to persuade her to adhere to her prescribed program of limited activity. After ten months there was a loss of seven and a half pounds in weight. Her blood showed a white count of 11,000, the smear, a reduction in level of lymphocytes from 48 to 20 per cent. The sedimentation rate rose from .3 to 8 mm per minute. Nevertheless she was discharged because of the lack of x-ray evidence of disease and the fervent denial of the presence of symptoms. Within four weeks after discharge she became acutely ill, and a film taken at the time showed a large new area of exudation on the right (Fig 6). Sputum was found positive.

This case, like the first, illustrates the ultimate achievement in the treatment of pulmonary tuberculosis, its apparent total extirpation. In the first case treatment was abandoned prematurely. In the second, a program of rehabilitation, although carried out, was inadequate. In neither case was a level of immunity reached adequate even for the minute residual disease. It is, therefore, our growing experience with cases such as the above that has made it clear to us that the patient, discharged from the sanatorium as apparently arrested, can cope with his two big unknowns, his residual disease and his slowly developing defenses only by a careful program of rehabilitation. This impression is borne out by a comparison between available figures for a five year survival and re-employment rate among patients discharged from sanatoria as apparently arrested without benefit of a rehabilitation program¹³ and the distinctly better figures shown after a rehabilitation program at Altro Work Shops.¹¹

B Medical Problems Encountered in the Course of Rehabilitation

Medical problems arising during rehabilitation are frequently different from those arising during the earlier part of the patient's treatment. Two reasons for these differences are as follows. First, the increased activity of the rehabilitation period brings to light physical disorders which may be masked while the patient is on markedly restricted activity. Second, the very treatment instituted in the sanatorium to convert the patient from sputum positive to negative occasionally introduces complications which retard or make impossible full physical rehabilitation. It is hoped, by summarizing our experiences, to contribute to a long ranged point of view with regard to the medical management of pulmonary tuberculosis that the all important efforts during the first part of the patient's illness to save his life and convert him from sputum positive to negative might avoid so far as possible irreversible measures interfering with subsequent rehabilitation. The various problems encountered are readily grouped as follows.

1 *Non Tuberculous Complications* These serve only to delay

the course of rehabilitation to some degree. Thus, episodes of acute appendicitis, gall bladder disease, hernias, and other surgical problems are to be expected and are handled with ease. Of greater importance are the pneumonias and other respiratory infections. During these illnesses the question is repeatedly presented as to whether a reactivation of the tuberculosis has taken place. Even minor episodes of acute bronchitis or tracheitis may lead to disturbing hemoptysis necessitating reevaluation of the medical status in each case and significant interruptions of programs. Relatively minor respiratory infections may have serious consequences through operation of heteroallergic reactions or through the Shwartzman phenomenon as elaborated by Rich.¹⁰ We have adopted the policy, therefore, of administering penicillin freely by inhalation to all patients suffering from respiratory infections of more than forty eight hours duration without significant improvement in an effort to minimize their disturbing influences.

Occasionally metabolic diseases in their incipency may tax the physician. Hyperthyroidism was encountered several times in young women during rehabilitation. The difficulty in distinguishing symptoms of this disease in its earliest stage from evidence of reactivating tuberculosis is obvious.

Non allergic asthma is a rather common finding, although no figures are available at this time indicating its exact frequency in tuberculosis. We have found very commonly among our trainees the symptom complex of wheeze, cough, and mild to severe paroxysms of dyspnea, occurring throughout the year, aggravated by exposure to dampness and occasionally to cold air, frequently precipitated by exercise and emotional disturbances, associated with the production of mucoid sputum never found positive. Until the exact nature of the symptomatology is clarified in each case frequent interruptions for evaluation of the status of these patients is necessary.

2 Problems Arising from Inadequate Measures During the First Period of Active Treatment These are common. The restricted regime of the sanatorium frequently gives a false sense of security with respect to a variety of conditions. Outstanding among these are two. One is the patient with a unilateral pneumothorax whose opposite side is not collapsed although a considerable amount of infiltration is present therein. Many breakdowns occur among these patients as their rehabilitation is attempted. Often symptoms are of sufficient magnitude to prevent these patients from passing beyond three to four hours of activity although they may maintain negative sputum.

Another common source of trouble is the patient with a pneu-

mothorax apparently successful during residence in the sanatorium despite the presence of adhesions. These patients find rehabilitation difficult. Loss of weight and strength and other complaints frequently make progress slow or impossible. In a few cases where pneumolysis was carried out after attempts at rehabilitation were found difficult, the prompt increase in appetite and strength which followed appears to have justified our wish that pneumolysis be carried out in every case during the first few weeks of pneumothorax whenever possible regardless of the apparently satisfactory result which may have been achieved without it. This long ranged view of our medical treatment would thus allow these patients to undergo a smoother course of rehabilitation.

Patients with a predilection for bronchial tuberculosis are frequently difficult to manage. We have repeatedly seen patients with negligible disease in the lung, who appear to be satisfactorily controlled while in the sanatorium, but after beginning to undertake a program of increased activity, develop positive sputum referable only to intrabronchial disease. These patients may have transient areas of atelectasis in their lungs. Collapse measures are of no benefit and frequently introduce further complications. Resection is futile because the disease ordinarily is not limited to a single area. Although they undergo frequent remissions, when increased activity is permitted, symptoms and positive sputum commonly reappear. It can only be hoped that chemotherapy may prove of value to these patients in the future.

3 Extrapulmonary Tuberculosis This complication will commonly manifest itself more readily during periods of increased activity. The most commonly encountered sites of extrapulmonary disease in our experience have been the glands, the kidneys, and the intestinal tract. In most cases symptoms had been present early in the sanatorium period of treatment. It was obvious that the restricted life of the sanatorium had masked the disease which became apparent as activity was allowed to increase. Only involvement of the genitourinary tract was considered sufficient to warrant immediate return to the sanatorium. No case of tuberculous adenitis was returned or held back appreciably in his progress. Cases of tuberculous enteritis were all considered individually. Thus far with adequate dietary management and moderate restriction of activity uninterrupted progress has been maintained in all cases.

4 Problems Arising from Therapeutic Measures Instituted During the Earlier Phase of Active Treatment These have been the most serious and the most difficult to manage. Chief among these is the unexpandable lung following a period of pneumothorax treatment. Recently summarized by Jacobs,⁶ this problem is confronted

sufficiently often to warrant great concern and a definite plan of management. The etiology of this predicament is obviously the combination of the following circumstances: a fixed mediastinum and a fibrotic lung enclosed by a thickened pleura. Bronchial stenosis is probably an early factor predisposing to the pulmonary fibrosis. Progressive negative pressure develops rapidly after introduction of air is abandoned. Fluid accumulates but does not prevent the subsequent discomfort and dyspnea which all these patients complain of. Repeated introduction of air must be continued indefinitely in order to insure an intrapleural pressure compatible with comfort. Occasionally these patients develop empyema, and an additional complication is thereby presented. These patients, then, face the necessity of maintaining an undesirable pneumothorax for the rest of their lives and must ever be fearful of a possible empyema. It is felt that these cases can for the most part be recognized while they are still in the sanatorium, and their future freed of its uncertainty there by a thoracoplasty. To carry out such a procedure on a patient after he has left the sanatorium involves obvious difficulty in obtaining the proper surgical skill for this procedure besides the emotional disturbances which necessarily follow the advice that a thoracoplasty is necessary after the first period of active treatment has been completed and the patient is well along on his way to rehabilitation.

Similar to the problem of the unexpandable lung is the problem of extrapleural pneumothorax. Like the patients with unexpandable lungs collapsed by intrapleural pneumothorax, thoracoplasty presents the only reasonable solution, when the lung fails to re-expand, and for the same reasons these patients are best handled by terminating the extrapleural pneumothorax while they are still being treated in the sanatorium.

Another complication which should be recognized early, because it is best handled while the patient is in the sanatorium, is intermittent bronchial obstruction with bronchiectasis. This is not an unusual complication especially following collapse measures such as pneumothorax and thoracoplasty.⁴ We are, therefore, occasionally called upon to rehabilitate patients whose sputum is negative but who have evidence of chronic pulmonary suppuration, which on investigation proves to be due to bronchiectasis. Although mild degrees of bronchiectasis need no treatment, those associated with severe symptoms, especially in conjunction with intermittent bronchial obstruction, can look forward to a normal life only after resection of their disease areas. It is otherwise futile to attempt a program of rehabilitation.

A syndrome pointed out recently,⁵ which interferes with the

nutrition of patients undergoing pneumothorax treatment to the left lung, is due to mechanical paralysis of the left hemidiaphragm. By elevation of the left intrapleural pressure, mobility of the left hemidiaphragm is mechanically impaired. This condition, in turn, leads to impaired adjustability of the stomach beneath it to increasing contents, thereby interfering with nutrition. This symptom complex of impaired appetite, loss of strength and weight wholly unrelated to active disease, has been an occasional stumbling block to many who attempt rehabilitation with this handicap. These patients are frequently helped by reducing the frequency and doses of refills. Occasionally it is necessary to abandon pneumothorax prematurely before rehabilitation can progress.

SUMMARY

Upon discharge from a sanatorium as clinically arrested, the patient with tuberculosis is confronted with two unknowns: the residual disease in his lung and the level of his immunity. The available evidence indicates that anatomical healing of tuberculous disease goes on for years after all clinical evidence of disease has gone, that the defense mechanisms of the body against the tubercle bacillus are elaborated slowly, and for many years the level of immunity fluctuates in response to many influences. These facts constitute the basis for the program of rehabilitation which permits the patient's activity to keep pace with his increasing immunity. Medical problems which are confronted during this period are classified and described. Suggestions for their handling are presented.

RESUMEN

Cuando se le da de alta del sanatorio como caso clínicamente estacionado, el tuberculoso pulmonar hace frente a dos incógnitas: la enfermedad residual en su pulmón y el nivel de su inmunidad. Los datos a nuestra disposición indican que la cicatrización anatómica de la tuberculosis continúa años después de que hayan desaparecido todos los signos clínicos de la enfermedad, que los mecanismos defensivos del cuerpo contra el bacilo tuberculoso se elaboran muy despacio y que el nivel de la inmunidad fluctúa por muchos años como resultado de muchas influencias. Estos hechos constituyen la base del programa de rehabilitación que permite que la actividad del paciente vaya mano a mano con su creciente inmunidad. Se clasifican y describen los problemas médicos a los que se hace frente durante este período y se indican algunas formas de solucionarlos.

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D i s c u s s i o n

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Otisville, New York

I am very glad that Dr Feinsilver has emphasized the fact that rehabilitation is an essential part of treatment. This is a statement that merits frequent repetition. Our object in caring for the tuberculous is to get the patient well and keep him so. This means that there must be no instability of the lesion, or clinical activity, while the patient has a specified work tolerance. Rehabilitation helps to meet these qualifications for the procurement and maintenance of the arrest of the tuberculous process.

Let us see how this works out in actual practice. In our sanatorium the *minimum* criteria for patients' assignments to rehabilitation are as follows: No symptoms, sputa, gastrics and cultures negative for at least three consecutive months, roentgenograms stable for the same period, no contraindicating complications, an ambulatory status for at least one month, collapse therapy effective, with a minimum of three months after initiation of pneumothorax and six months after thoracoplasty.

The initial rehabilitation assignment is for one hour a day, with

an increase of one hour each month. Our patients spend an average of three and one-half months in the program. These patients, therefore, at time of discharge, are really eligible for classification as arrested (they have stable roentgenograms for at least six months, negative bacteriology for the same period, and a daily work tolerance of three to four hours). In this manner the use of strict medical criteria for rehabilitation placement is a serviceable guide in treatment and helps to procure a status of arrest.

Rehabilitation strengthens and hardens the patient and improves his physical condition. Thus work tolerance can be developed with healing of the tuberculosis. Recovery is thereby aided and patients are prepared for their post-sanatorium responsibilities.

Patients should be discharged from institutions with a developed and known work tolerance. Without this the outside physicians will find it difficult to regulate the work allowance and patients will not be prepared for and will not know how much physical activity they can engage in.

It has been our experience that with constant medical supervision and control of the patients' progress, and rigid criteria for the placement of patients in the program, rehabilitation is a safe form of therapy. This pertains to all patients with good prognosis irrespective of stage of disease or type of therapy.

Many patients need complete vocational rehabilitation training to provide them with a new, suitable skill. It would be hazardous for this entire group to return to their former occupations. Sanatorium rehabilitation provides necessary and satisfactory skills, and when combined with a good post-sanatorium plan, can help the individual to become self-supporting in skilled employment and contribute to the attainment of adequate economic conditions. Thus rehabilitation attempts to control the higher tuberculosis morbidity and mortality among the unskilled and the poor.

I can only mention briefly the important mental or psychological benefits of rehabilitation. A good program can improve patients' morale, relieve their monotony, and develop optimism, confidence, hope and self-respect.

The period after sanatorium discharge is, in many respects, not the end but the beginning of treatment. The outcome in a case of tuberculosis depends on much more than the status of the patient at time of departure from the institution. Good rehabilitation, education, and a satisfactory follow-up plan are required. This means provision for close medical supervision, elimination of economic and environmental deficiencies, solution for the financial, health and social difficulties of patient and family, continuation of health education, adjustment of personality and emotional problems, regulation of the patients' work

tolerance and arrangement for vocational training and safe employment This type of service is necessary for years after discharge Then and only then it will be possible to maintain the benefits of sanatorium care and prevent breakdowns

No sanatorium medical and rehabilitation program, no matter how good, can stand by itself It requires contributions from nursing, social service, medical, neuropsychiatric, welfare, vocational and educational groups These sanatorium and community resources must be provided and integrated for the patient and family during the entire process of treatment from the time of diagnosis until complete adjustment of the patient and cure has been obtained Under such circumstances, it will be possible to restore patients to the "fullest physical, mental, social, vocational and economic usefulness of which they are capable "

The Tuberculosis Problem in the Philippines

MIGUEL CANIZARES, M.D., F.C.C.P.*

Quezon City, Philippine Islands

In the Philippines now, in a so-called era of peace, three years after Philippine liberation, tuberculosis still kills at the rate of four persons every hour around the clock. Due to the ravages of tuberculosis alone, the government loses one and a half billion dollars every year. It is the prime health and socio-economic problem in the Philippines, has been so for decades. From Pearl Harbor up to this date two wars have been raging in the Islands—one fought with shell, shrapnel and other infernal implements of destruction, another wherein the Four Horsemen plus parasitic infestation and moral and physical tension have been preying upon the populace facilitating subsequent invasion by disease.

The prewar tuberculosis death rate among Filipinos was 230 per 100,000 nearly six times as high as the 1945 rate for the United States. The Philippine death rate is certainly higher now. Whereas there are at least 500,000 cases of tuberculosis among the 18,000,000 population today, there are not more than a total of 1,200 institutional beds now available throughout the Philippines for this disease.

The Philippines has a total area about half the size of Texas. Its 18,000,00 inhabitants equal the combined populations of New Jersey and New York states.

To New Jersey's four million people, at least 4,203 beds (1942) for tuberculosis patients are available. In the entire Philippines, with a death rate nearly six times as high as that in New Jersey, not more than 1,200 beds can be found. Even before the war, this number was never any higher.

In the Philippines, tuberculosis has headed the list of causes of death for decades. Not even malaria can compete with tuberculosis mortality. At the war's outbreak, tuberculosis morbidity was 6.22 per cent, or 1,119,600 suspect cases, according to field surveys made in 1940. If half of these cases did not survive the war and if no new cases have cropped up since 1940, at least 500,000 tuberculous persons are probably still alive today. That figure is the minimum that can be arrived at.

Why is this so? What local conditions obtain which tend to

*Medical Director, Quezon Institute. Presented at the International Banquet of the American College of Chest Physicians, Atlantic City, New Jersey, June 5, 1947.

make the disease so prevalent and the campaign against it so limited in the Philippines?

Two organizations, which just before the war had some sort of mutual understanding, are concerned with antituberculosis activities—a voluntary organization, the Philippine Tuberculosis Society, and the government agency, which is the tuberculosis control section of the health bureau. The Philippine Tuberculosis Society was affiliated before the war with the National Tuberculosis Association and Le Union Internationale Contre le Tubercule. There was an arrangement according to which the Philippine health bureau unit was to take care of health statistics and case finding in field surveys while the Philippine Tuberculosis Society was to attend to the home and institutional management of cases. The educational work was jointly undertaken by both agencies. To this end, the Society operated four provincial tuberculosis pavilions, fourteen dispensary clinics, and a central sanatorium known as the Quezon Institute. The health bureau conducted a dispensary in Manila, provided 150 hospital beds for advanced cases, and operated four mobile x-ray units in field surveys. In 1940 these combined agencies examined by fluoroscopy and roentgenogram a total of 510,843 persons, or approximately 2.8 per cent of the population.

A Bit of History

The Philippine Tuberculosis Society was founded in 1910 by a small group of civic minded citizens. Initially it operated two small clinics in the slum districts of Manila, but gradually its activities expanded until in 1918 it was able to open a sanatorium in the outskirts of Manila. The sanatorium at first consisted of a few nipa huts or ramshackles. Year by year additions were built until in 1935 there were some twenty-seven cottages and huts. A diagnostic x-ray unit was acquired in 1927, and in 1929 seventeen patients were under pneumothorax therapy. Two years later, phrenic nerve operations and thoracoplasty were introduced in the Islands. Collapse therapy found such wide acceptance that at the outbreak of the war the Quezon Institute alone had 1,547 pneumothorax patients. Intrapleural pneumolysis was introduced in 1937. The Philippine Tuberculosis Society and the Quezon Institute started sending members of its staff abroad, especially to the United States, for advanced training.

The sanatorium operated by the Philippine Tuberculosis Society was renamed the Quezon Institute in 1938 after its sponsor, Manuel L. Quezon, who later died at Saranac Lake. It may be stated here that the late President Quezon was as interested in tuberculosis as the late President Roosevelt was in infantile

paralysis. He it was who sparked the antituberculosis campaign in the Philippines. Under Quezon's administration the sweepstakes law took effect, most of the income from which was set aside for use in the campaign against tuberculosis. These funds supplemented the proceeds from the Christmas Seal Sales.

After 1938 the activities of the Philippine Tuberculosis Society steadily expanded. Dispensary clinics and tuberculosis pavilions were opened in populous areas of the Islands. The wooden and nipa structures gave way to modern concrete sanatoria with accommodations for as many as 1,400 patients. A planigraph unit operated from 1939 to the outbreak of the war, clinical and research laboratories and a medical library were founded, an orthopedic service was established, a powerful G E apparatus with a miniature 4 x 5 x-ray unit was acquired in 1940, and a scientific publication was issued semi-annually containing the products of staff research. In 1938, the Society began training physicians, sent by the tuberculosis control section of the health bureau, in tuberculosis work for a minimum period of two years. Undergraduate medical students from three local medical colleges and nurses from schools of nursing also received clinical instruction and training in tuberculous and other chest diseases. Large industrial firms were starting to have regular x-ray check-ups of their employees, and x-ray examinations were also being made available for government employees, school teachers, and students and the public in general.

Into this setup, which gave promise of becoming nation-wide in scope, burst the attack on Pearl Harbor and the Pacific campaign like a thunderbolt from the blue.

Predisposing Factors

The following factors contribute to the prevalence of the disease in the Islands:

(a) *Poor housing* Housing was a problem even before the war. During the Pacific battles more than 300,000 homes were destroyed as a result of fighting and bombings so that the problem is now much more acute. Whole families have to double up, not in houses, but in makeshift sheds, shacks, and lean-tos (the barong-barong) without sanitary facilities. In the razed areas of Manila and its suburbs it is not uncommon to find three or four families squeezed into a shed measuring four by five yards, which leaks like a sieve during the rainy season and which is as hot as an oven during the summer months. Thus, spread of infection by close and continued contact is supremely easy. The War Damage Commission could do a lot to aid in rehabilitation by hastening the settlement

of claims although the results will be limited by the fact that an individual claimant cannot get more than \$500 00

It must be mentioned here that whole communities have been wiped out in some areas, the majority of their inhabitants massacred or maimed. In Manila virtually every federal building has been demolished, century-old historic buildings gutted, and some churches, museums, and libraries burned down. There is no question but that there is a dearth of public buildings and private dwellings in the entire young republic today.

(b) *Malnutrition* Even before the war it was an admitted fact that the Filipino race was so undernourished that every year beriberi killed more infants than did respiratory diseases. During the forty months of Japanese occupation not only did no imports reach the Philippines due to the blockade but the countryside likewise was stripped to feed and maintain upwards of one million unwelcome guests (the Japanese Imperial Army had no quartermaster supplies to speak of). The Japanese saw to it that their troops lived off the fat of the land, not caring whether the civilians starved. Hence, avitaminosis reared its head, and malnutrition contributed to the death of thousands.

Even now when nutrition is better, the high cost of living (the purchasing value of the peso is only one-fifth of its prewar level) is still taking its toll. Statisticians are agreed that for the next few years living costs will remain higher than the prewar level.

(c) *Parasitism* Intestinal parasitism infests about 70 per cent of the population. Ascariasis, Schistosomiasis, hookworm disease, trineasis, and amebiasis form the bulwark of Philippine parasites that choose man for their host. The ascarids, hookworm, schistosomes and strongylids, as they pass through the lungs in their life cycle, may cause some injury to the pulmonary tissue on their way to their respective habitat in the human body. Whether in this manner they predispose the lung to subsequent lodgment of the *Mycobacterium tuberculosis* has not yet been fully ascertained.

It is a fact, however, that widespread parasitism in the Islands not only contributes to the production of secondary anemia but so lowers the resistance of the human host that either latent tuberculosis or other intercurrent diseases may readily break out.

(d) *Dust and Fly problems* These two are peculiar to the tropics—as is the mosquito problem. Tropical dust is the most abundant in the world. Most Philippine highways were concrete or asphalted before the war, but the Japanese did no maintenance, and thousands of heavy U S Army vehicles have pulverized the best of the asphalted roads during the past two years. The dust of the highways, carried away by tropical winds, gets into your eyes, your nostrils, and into your every pore. Hence, respiratory diseases

enjoy a Roman holiday during the dry months, thereby activating many a quiescent tuberculous focus

As for flies, they can be found in droves every day of the year. With garbage and sewage disposal extremely inadequate since the end of the war, food, milk and water contamination plays a considerable role in the spread of infectious diseases.

(e) *Economic conditions* In addition to inadequate housing, the traditional low wages prevailing in the Orient and inflated prices of food and all other commodities contribute to a low constitutional resistance resulting in malnutrition. Filipinos were never milk drinkers, for, in a large majority of cases, fresh milk produces either diarrhea or tympanism.

As examples of these low wages, the common laborer earns an average of \$1.50 a day, physicians in the health service in charge of a county receive not more than \$75.00 a month, clerks and teachers about \$65.00 a month. Is it any wonder then that the children are so undernourished that they are easy prey to tuberculosis and other contagious diseases?

It must be stated here, in passing, that World War II's aftermath will be felt in the Islands for the next decade. While vital statistics for the whole Philippines is incomplete, tuberculosis incidence in the city of Manila, according to the Philippine health bureau, has risen from the pre-war figure of 9.07 per cent to 21.84 per cent, or an increase of 251 per cent. Last year there were 2,144 deaths due to tuberculosis in Manila, or a city incidence of 280 deaths per 100,000. At the war's end in 1945, 11,258 cases were found by the health bureau in the same city out of 51,550 fluoroscopic and x-ray examinations, or an incidence of 21.84 per cent.

Prewar Activities

The Philippine Tuberculosis Society's fourteen dispensary clinics, four provincial tuberculosis pavilions, and the Quezon Institute, for a twelve-month period from 1940 to 1941, reported the following activities:

Total dispensary attendance (examined by fluoroscopy miniature or regular x-ray films)	249,700
Home visits	114,620
Artificial pneumothorax insufflations	66,959
Other major and minor operations (at Quezon Institute)	1,109
Laboratory examinations	65,455
Number of pneumothorax patients (at Quezon Institute)	1,547
Number of admissions (at Quezon Institute)	1,236
Number of discharges (at Quezon Institute) of which 61.5 per cent had positive sputa and 38.5 per cent had negative sputa	1,146

The tuberculosis control section of the Philippine health bureau, during the ten-year period from 1933 to 1942, made 1,037,577 fluoroscopic and roentgenographic examinations with an incidence rate of 6 54 The average was 103,757 examinations a year

War Damage and Casualties

The war in the Pacific theater crippled the tuberculosis organization in the Philippines There is no other health unit which was harder hit by the war than the Philippine Tuberculosis Society and its dependencies Seven physicians on the staff died during the Japanese occupation One was killed or beheaded by the Japanese Over 100 male patients and employees of the Quezon Institute were bayoneted to death in the last days of fighting during the liberation of Manila Most of these patients were advanced cases and so weakened by disease and malnutrition that they could not walk alone

Eleven dispensary clinics and four tuberculosis pavilions—two of the latter brand new—were damaged beyond repair, all their equipment and supplies lost or burned The Quezon Institute proper, commandeered and occupied by the Japanese as a military hospital, was burned and greatly damaged by the Japanese before they evacuated it What equipment and utilities remained after the conflagration were looted Not only our research and clinical records since 1919 but ward, surgical, x-ray and laboratory equipment and supplies also perished in the Walled City fighting Our medical and research libraries perished in the same fashion

Damage sustained amount to at least two million dollars, irreplaceable are our burned medical books and literature, research records and x-ray and clinical records of patients dating from 1919 The tuberculosis section of the bureau of health likewise lost all their mobile x-ray units, four in number

Present Handicaps

It has been sixteen months now since the Quezon Institute started reoperating The 80th U S Army Base Hospital, which occupied the Quezon Institute for almost a year after liberation and made some repairs of the damaged buildings, turned over their surplus to us in late December of 1945 on memorandum receipt Some essential x-ray, surgical and clinical equipment is still lacking, and some of us have grown rusty and turned into nervous wrecks with the war years, but most of the old crowd is back and new hands are being trained again Present handicaps are many The condition of the sanitary facilities is one of the most serious of these handicaps, for most of our plumbing and electric fixtures were lost Water mains remain unrepaired, hence there is water

shortage in the Manila area. At the sanatorium it is very trying to have water for only three or four hours out of the twenty-four. That really poses a big problem when there are some 1,200 sanatorium residents to be taken care of.

Our sincere thanks are due to the National Tuberculosis Association, which has aided the Philippine Tuberculosis Society in various ways. The NTA has given us an outright financial donation of \$5,000—when we were without any funds—Christmas Seals, medical books, magazines, journals, educational posters, pamphlets and moving picture films, all of which not only have been of great practical and material help but also have bolstered our morale considerably. We desire likewise to express our appreciation to many American doctors who have sent us relief supplies and medical literature and books.

At present we have been enabled to reopen five provincial dispensary clinics although only three of them have x-ray facilities.

The biggest problem of all is an insufficiency of funds for tuberculosis work. Even the governmental tuberculosis control section, which is being aided directly by the USPHS, has the same financial problem. The USPHS has given us a \$5,000 donation for surgical equipment and two small x-ray units for which we are deeply grateful. There are now two miniature x-ray units and 230 hospital beds for the tuberculous sponsored by the bureau of health agency.

The present tuberculosis setup in the Philippines has a group of trained men and the spirit to combat tuberculosis. But it has only 1,200 beds whereas 70,000 are needed, not more than ten x-ray units when at least twenty times that number are required. A program of expansion is on its way, depending upon available funds. The spirit is there—the spirit that gave birth to Bataan and Corregidor—even after the echoes of the most horrible war have only barely receded into the distance. Yet there is still “war” in this era of peace, the war against tuberculosis, as an already prostrate people succumb from tuberculosis alone at the rate of four deaths every hour.

Notwithstanding which the people of the Philippines go ahead calmly, and without complaining endure their suffering in silence. The new Republic marches on with the Captain of the Men of Death stalking just behind. He carries a dark mantle in both hands but life in the Philippines now, after the terrible misery and agony and devastation and cruelty of the war years, is comparatively sweet even if it is but a “tiny gleam of time between two eternities.”

Streptomycin

A Report on Its Present Use in Tuberculosis

Indications for Treatment

Nearly all forms of tuberculosis respond in some degree to treatment with streptomycin. By no means, however, should the drug be used universally or indiscriminately. In pulmonary tuberculosis, especially, careful selection of cases is necessary. This entails an understanding of the pathology of the disease and of the fundamentals of chemotherapy.

It should be emphasized again and again that streptomycin is not a substitute for sanatorium care and other proven procedures. Rather it is an adjunct to these other measures and is more valuable when used in conjunction with other methods of treatment. Like other drugs it has its assets and limitations.

Although extremely difficult to lay down hard and fast rules for the use of streptomycin in pulmonary tuberculosis, the following statements may be made on the basis of controlled studies. It is well known that exudative disease is the only type of tuberculous infiltration which is reversible with chemotherapy. Streptomycin has its greatest usefulness, therefore, in cases with an appreciable amount of such pathology. The bacteriostatic effect of streptomycin is responsible for symptomatic improvement and for the prevention of complications in the caseous and fibrotic types of pulmonary tuberculosis, but, alone, is not sufficient nor adequate treatment to arrest the disease in most cases. Following is a suggested summary of indications for the use of streptomycin in pulmonary tuberculosis.

1) *Definitive treatment* As such, the place of streptomycin is limited and includes chiefly acute progressive pulmonary lesions of recent origin with little or no destruction of tissue. This category includes progressive primary tuberculosis, tuberculosis due to hematogenous and bronchogenic dissemination, and some cases of acute caseous pneumonia.

2) *Preparation for surgical procedures, including temporary and permanent collapse and excisional surgery* Streptomycin may be used routinely but is better reserved for cases offering particular indications. These include toxemia, laryngeal and bronchial infection, and evidence of spreading disease. In acute cases pneumothorax can be instituted earlier and with greater safety if streptomycin is administered. Likewise, improvement under streptomycin therapy may cause a patient to become an acceptable candidate for thoracoplasty whose pathology and general condition

previously contraindicated this procedure. In all excisional surgery of the lung, streptomycin should be used as a routine prophylaxis. It may be well to remember that since the period of greatest activity of streptomycin extends over a limited time, that its use in pulmonary tuberculosis should bear a relationship to any collapse or surgical procedure indicated. Consideration of the complete treatment of the patient should accompany planning of streptomycin therapy.

3) *Symptomatic treatment of other conditions incidental to the pulmonary tuberculosis*. In extrapulmonary tuberculosis streptomycin often provides definitive treatment and has altered the prognosis in many conditions. It is the only treatment of any avail in disseminated tuberculosis. The course of tuberculous meningitis tends to be modified and a small per cent of cases attain clinical and bacteriologic remission. When generalized miliary tuberculosis is not complicated by meningitis, the per cent of recoveries is high. Streptomycin is the treatment of choice, also, for tuberculous sinuses, tuberculosis of the oropharynx, larynx and tracheobronchial tree, tuberculous enteritis and peritonitis, tuberculous otitis media, tuberculous pericarditis, and possibly for ocular tuberculosis. In renal tuberculosis, symptomatic improvement is usually prolonged, and bacteriologic conversion occurs in some cases. Tuberculosis of the bones and joints is improved by treatment with streptomycin in approximately half of all cases, the response being best early in the course of the disease. Streptomycin in the treatment of tuberculous empyema has not proved to be effective.

Streptomycin is of decided value in conjunction with the surgical treatment of a number of extrapulmonary tuberculous conditions. It is valuable as pre-operative and post-operative treatment in surgery of the genito-urinary tract, surgery of bones and joints, pericardiolysis, incision and drainage of abscesses, and fistulectomy.

4) *Use of streptomycin during pregnancy*. Investigators generally have hesitated to give streptomycin to patients during pregnancy for fear of possible ill-effects on the foetus, particularly with regard to the vestibular mechanism. Less than a dozen such cases in which streptomycin was administered to patients in the course of their pregnancy have come to the attention of this committee. In each instance, the child has been apparently normal at birth and has developed normally to date. However, until more adequate evidence has accumulated we would urge extremely cautious use of the drug in such cases, with dosage of not more than 0.5 gram daily, and for a relatively short period of time—three to six weeks. It is fervently hoped that further evidence will indicate that judicious use of streptomycin may make the termination of

pregnancy unnecessary in many cases where it now seems mandatory

Administration and Dosage

Streptomycin is administered systemically, by intra-muscular or deep subcutaneous injection. Local treatment apparently can be dispensed with except in tuberculous meningitis. In this condition results apparently are best when intramuscular injection is supplemented by intrathecal injection of from 25 to 100 milligram every twenty-four to forty-eight hours for two or three months, or as long as this method of administration is tolerated by the patient.

The optimal regimen for the administration of streptomycin has not been determined. Possibly the regimen should be varied according to the body weight of the patient and the type and severity of the disease. In disseminated tuberculosis treatment should be vigorous, a dose of two grams a day being given for several months. In most other forms of tuberculosis results appear to be satisfactory when relatively small doses are administered for only a few weeks. A dose of 0.5 to 1 gram a day administered in one injection for six to eight weeks is usually sufficient. With this mode of therapy complications are very infrequent and in most cases their clinical importance may be discounted.

Since the appearance of resistance to streptomycin apparently is closely related to duration of treatment, regardless of the daily dosage, limitation of the period to a few weeks may be effective in avoiding the phenomenon in many cases. Discontinuous treatment is also being investigated as a method of preventing bacterial resistance. At Fitzsimons General Hospital, the administration of streptomycin at three, four, and five-day intervals was therapeutically effective, and preliminary results indicated a significant decrease in the occurrence of resistance.

Although more than one course of streptomycin treatment is not generally indicated, occasions may arise where this will be advantageous. A previously treated patient may have become sensitive to the drug. The initial dose, therefore, should be very small and the customary half gram dosage not be used unless no reaction occurs.

Other Chemical and Antibiotic Substances

At present, no chemotherapeutic substance is available which can compare with the efficacy of streptomycin against tuberculosis. However, there are a number of other drugs which are antibacterial experimentally, and investigations are in progress to determine whether a combination of any of these drugs with

streptomycin may have a synergistic action which is clinically significant. In addition, it is hoped that combined therapy may be successful in preventing development of resistant strains of tubercle bacilli.

The sulfone compounds promin and promizole, and para-aminosalicylic acid are the chief agents available at present for the investigation of these problems. Promin is too toxic when administered orally for general usage, but the drug is tolerated fairly well when administered intravenously in doses from 2 to 5 grams a day for several months. Promizole is relatively free from toxic side reactions in large doses orally and it is hoped that further clinical investigation may prove it to be of value as a synergist. Para-aminosalicylic acid apparently has no serious side effects, but the gastro-intestinal disturbances which it causes may prevent adequate dosage. Insufficient data has been accumulated on the use of para-aminosalicylic acid alone to determine its effectiveness clinically in the various forms of tuberculosis.

Although effective against the tubercle bacillus in vitro, subtilin has not as yet been subjected to the extensive animal experimentation which must precede clinical investigation.

Submitted for the Committee on the Management and Treatment of Diseases of the Chest by the Sub-Committee on Chemotherapy and Antibiotics

Sub-Committee on Chemotherapy and Antibiotics

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The Council on International Affairs, which is comprised of the chairmen of the Councils on Pan American Affairs, European Affairs and Pan Pacific Affairs, together with a General Chairman and a Secretary, serves to correlate the activities of these councils The membership of the College outside of the United States is shown in Table I

TABLE I — MEMBERSHIP
 COUNTRIES AND TERRITORIES OUTSIDE THE CONTINENTAL
 LIMITS OF THE UNITED STATES

	Fellows	Associate Members	<i>Applications Pending</i>		Totals
			Fellows	Associate Members	
Alaska	2	1	1		4
Argentina	30	56	1		87
Australia	14	12			26
Austria	1				1
Belgium	1	19	1		21
Bolivia	1	5			6
Brazil	48	59	3	6	116
Canada	81	15	7	2	105
Chile	11	46	1		58
China	5	5	5	1	16
Colombia	2	8			10
Costa Rica	4	3			7
Cuba	10	16			26
Czechoslovakia	1				1
Dominican Republic	1	1			2
Ecuador	7	6			13
Egypt	1				1
El Salvador	4	1			5
England	2	7			9
France	2	8	1		11
Germany			2		2

TABLE I (CONTINUED)

	Fellows	Associate Members	<i>Applications Pending</i>		Totals
			Fellows	Associate Members	
Greece	4	10			14
Guatemala	1	5			6
Haiti	2	3			5
Hawaii	13	6			19
Hungary	1				1
India	12	4			16
Ireland	2		1	1	4
Italy	2				2
Jamaica	1				1
Korea	1				1
Lebanon	3				3
Madeira Islands				1	1
Mexico	19	37			56
Netherlands			2		2
New Zealand		1			1
Nicaragua		1			1
Norway	1				1
Palestine	1				1
Panama	9	1			10
Paraguay	2	1			3
Peru	12	11			23
Philippine Islands	14				14
Portugal	7	10			17
Puerto Rico	35	8			43
Scotland		1			1
South Africa	21	3		1	25
Spain	1		1		2
Sweden	1		1		2
Switzerland	5	1			6
Trinidad	1				1
Turkey	1		1		2
Uruguay	10	10			20
Venezuela	26				26
Yugoslavia	1				1
TOTALS	437	381	28	12	858

The annual meetings of the College have become international assemblies Eighty-one (81) physicians from 26 countries, including four United States Possessions and territories, registered at the 14th Annual Meeting of the American College of Chest Physicians held in Chicago, Illinois, June 17-20, 1948, as shown in Table II

TABLE II

REGISTRATION FROM U S POSSESSIONS AND OTHER COUNTRIES
AT THE FOURTEENTH ANNUAL MEETING, JUNE 17 - 20, 1948,
CONGRESS HOTEL, CHICAGO, ILLINOIS

<i>United States Possessions</i>	<i>Number Registered</i>	<i>Other Countries (continued)</i>	<i>Number Registered</i>
Alaska	1	England	1
Hawaii	3	France	2
Puerto Rico	2	Guatemala	2
Virgin Islands	1	India	1
		Iraq	1
<i>Other Countries</i>		Ireland	1
Argentina	8	Korea	1
Australia	4	Mexico	10
Brazil	2	New Zealand	1
Canada	23	Pakistan	1
Chile	1	Peru	2
China	3	South Africa	1
Cuba	5	Spain	2
Ecuador	2	Venezuela	1
		TOTAL	81

Physicians from 11 countries participated in the scientific program presented at the 14th Annual Meeting of the College The council is studying several proposed plans for conducting bilingual meetings of the College

The Committee on Scientific Program for the 15th Annual Meeting of the College, to be held in Atlantic City, New Jersey, June 2-5, 1949, is giving consideration to a number of requests received from physicians in other countries for places on the program All such requests should be addressed to Dr Paul H Holinger Chairman, Committee on Scientific Program, 700 North Michigan Avenue, Chicago, Illinois

It is the plan of the Council on International Affairs to encourage the establishment of College chapters in as many countries as possible (Table III) The Board of Regents of the College requires that there be a minimum of 15 Fellows and/or Associate Members in a country or section of a country before a charter may be granted for the purpose of organizing a College chapter In accord with the College By-Laws, the affairs of College chapters are to be conducted by the local members who are in good standing in the international organization They shall elect their own officers and appoint such committees as is deemed necessary to

TABLE III

COLLEGE CHAPTERS IN THE UNITED STATES POSSESSIONS
AND IN OTHER COUNTRIES*Cuban Chapter (Organized December 24 1940)*

Octavio Rivero M.D Havana	President
Rene G Mendoza M.D Havana	Vice-President
O Suarez de Bustamente M.D Havana	Secretary-Treasurer
<i>Past Presidents</i>	
Alfredo Antonetti M.D., Havana	
Gustavo Aldereguia M.D Havana	
O Suarez de Bustamente M.D Havana	

Central Brazilian Chapter (Organized November 13 1942)

Mazzini Bueno M.D Rio de Janeiro	President
Vice-Presidents Ugo Pinheiro Guimaraes M.D	
Jose Amelio M.D	
Jayme dos Santos Neves M.D	
Gastao Mattos M.D	
Affonso MacDowell Filho M.D Rio de Janeiro	Secretary
Joao Martins Castello Branco M.D Rio de Janeiro	Treasurer

Puerto Rico Chapter (Organized January 31 1943)

Jalme F Pou M.D Hato Rey	President
Jose A Amadeo M.D Albonito	Vice-President
Fernando L Buxeda M.D Rio Piedras	Secretary-Treasurer
<i>Past Presidents</i>	
David Garcia M.D Hato Rey	
Antonio Acosta Velarde M.D Santurce	

Mexican Chapter (Organized September 9 1943)

Donato G Alarcon M.D Mexico City	President
I Cosio Villegas M.D Mexico City	Vice-President
Manuel Alonso M.D Mexico City	Secretary-Treasurer

Argentine Chapter (Organized April 29 1944)

Agustin Caeiro M.D Cordoba	President
Justo Lopez Bonilla M.D Rosario	Vice-President
Angel N Bracco M.D Buenos Aires	Secretary-Treasurer
<i>Past Presidents</i>	
Gumersindo Sayago M.D Cordoba	
Raul F Vaccarezza M.D Buenos Aires	

Peru Chapter (Organized August 13 1944)

Ramon Vargas-Machuca M.D Lima	President
Juan M Escudero Villar M.D Lima	Vice-President
Leopoldo Molinari M.D Lima	Secretary
Luis E Hubner M.D Callao	Treasurer
Angel Luis Morales M.D Lima	Librarian
<i>Past Presidents</i>	
Ovidio Garcia Rosell M.D., Lima	
Max Espinoza Galarza M.D., Lima	

Greek Chapter (Organized March 18 1946)

Basil Papanicolaou M.D Athens	President
Kyriakos Katrakis M.D Athens	Vice-President
Nicholas Jannopoulos M.D Athens	Secretary-Treasurer
<i>Past President</i>	
Nicholas Oekonomopoulos M.D Athens	

North Brazilian Chapter (Organized October 1946)

Jose Silveira M.D Salvador	President
Walter Boaventura M.D Bahia	Secretary-Treasurer

Chilean Chapter (Organized April 1947)

Rene Garcia Valenzuela M.D., Santiago	President
Vice-Presidents Gilberto Zamorano M.D., Valparaiso	
Gonzalo Corbalan Trumbull M.D., Santiago	
Ildefonso Garreton Unda M.D., Concepcion	
Salvador Diaz M.D Santiago	Secretary-Treasurer
<i>Past President</i>	
Hector Orrego Puelma M.D Santiago	

TABLE III (Continued)

<i>Venezuelan Chapter (Organized May 20, 1947)</i>	
Jose Ignacio Baldo, M.D., Caracas	President
Julio Criollo Rivas, M.D., Caracas	Vice-President
Rogelia Valladares, M.D., Caracas	Secretary-Treasurer
<i>South Brazilian Chapter (Organized September 28, 1947)</i>	
Clovis Correa, M.D.	President
Newton Toledo Ferraz, M.D.	Secretary
Mozart Tavares de Lima, M.D.	Secretary
Bindo Guida Filho, M.D.	Treasurer
<i>Central American Chapter (Organized November 14, 1947)</i>	
Rafael Leal H., M.D., Guatemala City	President
Maximo Carrizo Villarreal, M.D., Colon	Vice-President
Fausto Aguilar Rodriguez, M.D., Guatemala City	Secretary-Treasurer
<i>South African Chapter (Organized April 8, 1948)</i>	
David P. Marais, M.D., Cape Town	President
Theodore Shrire, M.D., Cape Town	Vice-President
Hildebrand H. Jacob, M.D., Cape Town	Secretary-Treasurer
<i>Uruguay Chapter (Organized July 31, 1948)</i>	
Victor Armand Ugon, M.D., Montevideo	President
Rodolfo Almelda Pintos, M.D., Montevideo	Vice-President
Julio Cesar Barani, M.D., Montevideo	Secretary-Treasurer

carry on the activities of the chapter. All College chapters are required to meet at least once a year for the purpose of presenting a scientific program and electing officers.

The Board of Regents may designate the countries and territories which are to be represented on their Board. Countries that have established College chapters are entitled to representation on the Board of Regents.

All members of the Board of Regents are elected by the general assembly at the annual meeting of the College. However, in the interim between annual meetings, the President of the College may appoint Regents in such countries or territories where this action is deemed advisable. The Board of Regents meets annually at the time of the annual meetings of the College (Table IV).

TABLE IV
REGENTS OF THE COLLEGE IN UNITED STATES POSSESSIONS
AND OTHER COUNTRIES

Argentina—Gumersindo Sayago, M.D.	Cordoba
Australia—Sir Sidney Sewell	Melbourne
Brazil—Affonso MacDowell, M.D.	Rio de Janeiro
Canada—William E. Ogden, M.D.	Toronto
Central America—Amadeo Vicente Mastellari, M.D.	Panama City
Chile—Hector Orrego Puelma, M.D.	Santiago
Cuba—Antonio Navarrete, M.D.	Havana
Ecuador—Juan Tanca Marengo, M.D.	Guayaquil
Greece—Nicholas Oekonomopoulos, M.D.	Athens
Hawaii—Hastings D. Walker, M.D.	Honolulu
India—Raman Viswanathan, M.D.	New Delhi
Mexico—Donato G. Alarcon, M.D.	Mexico City
Peru—Ovidio Garcia Rosell, M.D.	Lima
Puerto Rico—Luis A. Passalacqua, M.D.	Santurce
South Africa—David P. Marais, M.D.	Cape Town
Switzerland—Gustav Maurer, M.D.	Davos
Venezuela—J. Ignacio Baldo, M.D.	Caracas

Each country in which there are College members may have representation on the Board of Governors. The number of Governors in any country is to be left to the discretion of the Board of Regents. All members of the Board of Governors are elected by the general assembly at the annual meetings of the College, and the President of the College may appoint Governors in countries where this action is deemed advisable during the interim between annual meetings (Table V).

Recommendations for the election of Regents and Governors

TABLE V
GOVERNORS OF THE COLLEGE IN UNITED STATES POSSESSIONS
AND OTHER COUNTRIES

Alaska—Anibal R. Valle, M.D.	Seward
Argentina—Raul F. Vaccarezza, M.D.	Buenos Aires
Australia	
Victoria—John Bell Ferguson, M.D.	Melbourne
New South Wales—William Cotter Harvey, M.D.	Sydney
South Australia—D. R. W. Cowan, M.D.	Adelaide
Brazil	
Central Brazil—Reginaldo Fernandes, M.D.	Rio de Janeiro
Northern Brazil—Jose Silveira, M.D.	Salvador
Southern Brazil—Eduardo T. Etzel, M.D.	Sao Paulo
Canada	
Quebec—J. A. Couillard, M.D.	Mont Joli
Ontario—H. I. Kinsey, M.D.	Toronto
Eastern Provinces—A. F. Miller, M.D.	Kentville N. S.
Western Provinces—George Ferguson, M.D.	Melville Sask.
Chile	
Valparaiso—Gilberto V. Zamorano, M.D.	Valparaiso
Santiago—Gonzalo Corbalan, T. M.D.	Santiago
Concepcion—Ildefonso Garretón Unda, M.D.	Concepcion
China—Shu-Fan Li, M.D.	Hong Kong
Colombia—Carlos Arboleda Diaz, M.D.	Bogota
Costa Rica—Raul Blanco Cervantes, M.D.	San Jose
Cuba—Octavio Rivero, M.D.	Havana
Dominican Republic—J. M. Moscoso Cordero, M.D.	Trujillo
Ecuador—Jorge A. Higgins, M.D.	Guayaquil
El Salvador—Carlos Gonzalez B., M.D.	San Salvador
France—Paul Veran, M.D.	Nantes
Greece—Basil Papanicolaou, M.D.	Athens
Guatemala—E. Coronado Iturbide, M.D.	Guatemala City
Haiti—Louis Roy, M.D.	Port-au-Prince
Hawaii—William F. Leslie, M.D.	Hilo
India—Prag Nath Kapur, M.D.	Delhi
Korea—In Sung Kwak, M.D.	Seoul
Lebanon—Papken Mugrditchian, M.D.	Beirut
Mexico—I. Cosío Villegas, M.D.	Mexico City
Nicaragua—Rene Vargas L., M.D.	Managua
Norway—Carl B. Semb, M.D.	Oslo
Panama—Augustin A. Sosa, M.D.	Panama City
Paraguay—Angel Gines, M.D.	Asuncion
Peru—Juan A. Werner, M.D.	Lima
Philippine Islands—Miguel D. Canizares, M.D.	Manila
Portugal—Lopo de Carvalho, M.D.	Lisbon
Puerto Rico—A. M. Marchand, M.D.	Santurce
South Africa	
Northern States—P. J. Kloppers, M.D.	Pretoria
Southern States—Theodore Schrire, M.D.	Cape Town
Uruguay—Fernando D. Gomez, M.D.	Montevideo
Venezuela—Julio Criollo Rivas, M.D.	Caracas

may come from the officials of College chapters or from any member of the College residing in the country or territory in which a Regent or Governor serves. These recommendations should be addressed to the Committee on Nominations and mailed to the Executive Offices of the College in Chicago, Illinois.

Council on Pan American Affairs

Chevalier L. Jackson, M.D., Philadelphia, Pennsylvania, Chairman
 Raul F. Vaccarezza, M.D., Buenos Aires, Argentina, Vice-Chairman
 Juan R. Herradora, M.D., Jersey City, New Jersey, Secretary
 Donato G. Alarcon, M.D., Mexico City, Mexico
 Gustavo Aldereguia, M.D., Havana, Cuba
 Jose Antezana Estrada, M.D., La Paz, Bolivia
 Carlos Arboleda Diaz, M.D., Bogota, Colombia
 Jose Ignacio Baldo, M.D., Caracas, Venezuela
 Alvaro E. Bence, M.D., Buenos Aires, Argentina
 Juan Max Boettner, M.D., Asuncion, Paraguay
 J. A. Couillard, M.D., Quebec, Canada
 Edgar W. Davis, M.D., Washington, D. C.
 James S. Edlin, M.D., New York, New York
 Leo Eloesser, M.D., San Francisco, California
 Reginaldo Fernandes, M.D., Rio de Janeiro, Brazil
 Ovidio Garcia Rosell, M.D., Lima, Peru
 Fernando D. Gomez, M.D., Montevideo, Uruguay
 Jorge A. Higgins, M.D., Guayaquil, Ecuador
 Affonso MacDowell, M.D., Rio de Janeiro, Brazil
 Amadeo V. Mastellari, M.D., Panama City, Panama
 Antonio Navarrete, M.D., Havana, Cuba
 H. Orrego Puelma, M.D., Santiago, Chile
 Arthur Q. Penta, M.D., Schenectady, New York
 Octavio Rivero, M.D., Havana, Cuba
 Jose Rodriguez Pastor, M.D., Santurce, Puerto Rico
 Juan Tanca Marengo, M.D., Guayaquil, Ecuador
 Gumersindo Sayago, M.D., Cordoba, Argentina
 Jose Silveira, M.D., Salvador, Brazil
 Henry C. Sweany, M.D., Chicago, Illinois
 Gilberto Zamorano, M.D., Valparaiso, Chile

The Council on Pan American Affairs of the College was organized in 1942 to stimulate College activities in the Latin American countries and to help bring about a closer relationship among all of the chest specialists in the Western Hemisphere. Dr. Chevalier L. Jackson has served as the Chairman of this council since its inception. It was the aim of the council to establish chapters of the College in all the Latin American countries. The accomplishment of this part of their program is a tribute to the enthusiasm and leadership of Dr. Jackson. More recently, Dr. Juan R. Herradora, who is serving as Secretary of the council, has taken an active part in its affairs.

To date, twelve College chapters have been organized by the Council on Pan American Affairs and at the present time there are 610 members and 20 applications pending (Table VI).

Argentina (Membership 86, Applications Pending 1, College Chapter)

The Argentine Chapter has sponsored a number of meetings at which scientific papers of interest to chest specialists were presented. Dr. Chevalier L. Jackson was the guest of honor at the last meeting of the chapter held at Tigre, Cruz Colorada, in December, 1947.

TABLE VI
MEMBERSHIP — PAN AMERICAN

	Fellows	Associate Members	Applications Pending		Totals
			Fellows	Associate Members	
Argentina	30	56	1	1	87
Bolivia	1	5			6
Brazil	48	59	3	6	116
Canada	81	15	7	2	105
Chile	11	46	1		58
Colombia	2	8			10
Costa Rica	4	3			7
Cuba	10	16			26
Dominican Republic	1	1			2
Ecuador	7	6			13
El Salvador	4	1			5
Guatemala	1	5			6
Haiti	2	3			5
Jamaica	1				1
Mexico	19	37			56
Nicaragua		1			1
Panama	9	1			10
Paraguay	2	1			3
Peru	12	11			23
Puerto Rico	35	8			43
Trinidad	1				1
Uruguay	10	10			20
Venezuela	26				26
TOTALS	317	293	12	8	630

Bolivia (Membership 6)

The College program of organization is being developed in Bolivia. When the minimum number of members have been admitted to the College they will be granted authorization to organize a College chapter.

Brazil (Membership 107, Applications Pending 9 3 College Chapters)

Originally, Brazil had one chapter for the entire country. Because of the great distances to be traveled to a central point for the purpose of conducting meetings, it was deemed advisable to establish three separate chapters: one for the northern states, one for the central states, and another for the southern states of Brazil. More recently there has been some discussion regarding the establishment of a fourth chapter to cover the northeastern states of Brazil. This matter is now before the Board of

Regents of the College for consideration All of the College chapters in Brazil have held scientific meetings and a reunion of all of the Brazilian Chapters is planned to be held in Pernambuco in November of this year This meeting will be held jointly with the 4th National Congress on Tuberculosis

Canada (Membership 96, Applications Pending 9)

At the meeting of the Board of Regents of the College held in Chicago in June, 1948 the Regent of the College for Canada proposed that the Canadian members be invited to participate in the chapter meetings in the states and territories adjacent to their provinces This proposal was unanimously adopted by the Board of Regents and the secretaries of College chapters in the states bordering Canada are to be notified of this decision Such an arrangement has existed in the Pacific Northwest for a number of years where members of the College in British Columbia meet regularly with the Pacific Northwest District Chapter of the College

Central America (Membership 29, College Chapter)

The Central American Chapter is comprised of Costa Rica (7), El Salvador (5), Guatemala (6), Nicaragua (1) and the Republic of Panama (10) The chapter was organized on November 14, 1947 and their first meeting was held in San Salvador

Chile (Membership 57, Applications Pending 1, College Chapter)

Chile, with its three important medical centers in Santiago, Valparaiso and Concepcion, has been concerned with building the College membership in those cities As soon as this phase of the program is completed, Chile will develop the other activities of the College program

Colombia (Membership 10)

Colombia is attempting to organize a College chapter and is at present engaged in bringing its membership up to the required number for this purpose

Ecuador (Membership 13)

Conferences have been held with the officials of the College in Ecuador with a view towards establishing a College chapter in that country Ecuador is making good progress in obtaining the required number of members in order to apply for a charter for the organization of a College chapter

Mexico (Membership 56, College Chapter)

In January 1949, Mexico is to serve as host to the 8th Congress of the Union of Latin American Tuberculosis Societies (ULAST) The officers of the Congress are

Dr Imael Cosio Villegas, President
Dr Donato G Alarcon, Vice-President
Dr Miguel Jimenez, Vice-President
Dr Fernando Gomez, Permanent Secretary
Dr Fernando Rebora, General Secretary
Dr Manuel Alonso, Secretary of the Exterior
Dr Carlos Noble, Secretary of the Interior
Dr Rafael Ibarra, Secretary of the Sessions
Dr Carlos Diez Fernandez, Secretary of Publications
Dr Fernando Katz, Treasurer

A more detailed announcement of this meeting is being published elsewhere in this issue of the journal

Dr Donato G Alarcon, Mexico City, serves as Vice-Chairman of the Committee on the Management and Treatment of Diseases of the Chest of the College

The 'Revista Panamericana de Medicina y Cirugia del Torax' published in Mexico City, carries news notes of College activities in Spanish

Paraguay (Membership 3)

Correspondence between the Governor and members of the College in Paraguay and the Executive Offices of the College in Chicago has been primarily concerned with the building of College membership in that country

Peru (Membership 23, College Chapter)

The Peruvian Chapter has been conducting annual meetings at which time scientific programs have been presented Dr Manuel Albertal, Buenos Aires Argentina, a member of the Committee on Chemotherapy and Antibiotics of the College was the guest of honor at a special meeting arranged for the purpose of receiving the report from the committee on the recent developments in the use of streptomycin in the treatment of tuberculosis

Peru served as host at the last meeting of ULAST in March 1947 During the Congress a special breakfast meeting of the Governors and Regents of the College in the Latin American countries was held and a luncheon meeting was given in honor of all of the College members attending the Congress

Uruguay (Membership 20 College Chapter)

The most recent chapter of the College was organized in Montevideo, Uruguay on July 21, 1948 Dr Chevalier L Jackson was the guest of honor at the inauguration festivities The Council on Pan American Affairs extends its congratulations to Dr Fernando Gomez, the Governor of the College for Uruguay and to all of the members of the College in that country upon this achievement

Venezuela (Membership 26 College Chapter)

The Venezuelan Chapter of the College was organized May 20, 1947 Dr Richard H Overholt President of the College, was the guest of honor at the inauguration of this chapter More recently, the Venezuelan Chapter has been visited by Dr Edgar Mayer New York City, and by Dr Irving Willner Newark New Jersey Dr Jose Ignacio Baldo of Caracas serves as a member of the Committee on the Management and Treatment of Diseases of the Chest of the College

WEST INDIES (Membership 78 2 College Chapters)

Cuba (Membership 26 College Chapter)

The Cuban Chapter was the first College chapter to be organized outside of the United States The second joint meeting of the Cuban Chapter and the Southern Chapter of the College in the United States is to be held in Havana on October 26 1948 The program to be presented at this meeting is published elsewhere in this issue of the journal

Puerto Rico (Membership 43, College Chapter)

The Puerto Rico Chapter has been conducting scientific meetings at regular intervals Dr Juan R Herradora, Secretary of the Council on Pan American Affairs, was the guest of honor at a recent meeting held in San Juan

Dominican Republic (Membership 2)*Haiti* (Membership 5)*Jamaica* (Membership 1)*Trinidad* (Membership 1)

Correspondence between the College officials, the College members in these islands, and the Executive Offices of the College is being carried on to assist them in obtaining the latest information in the specialty of diseases of the chest

Council on European Affairs

Andrew L Banyai, M D, Milwaukee, Wisconsin, Chairman
Joseph C Placak, M D, Cleveland, Ohio, Vice-Chairman
Peter A Theodos, M D, Philadelphia, Pennsylvania, Secretary
Lopo de Carvalho, M D, Lisbon, Portugal
Ronald V Christie, M.D, London, England
Seymour M Farber, M D, San Francisco, California
Paul H Holinger, M D, Chicago, Illinois
Gustav Maurer, M.D, Davos, Switzerland
Robert T Neubauer, M.D, Ljubljana, Yugoslavia
Nicholas Oekonomopoulos, M D, Athens, Greece
Hilary Roche, M D, Montana, Switzerland
Luis Saye, M D, Buenos Aires, Argentina
Paul Veran, M D, Nantes, France

The Council on European Affairs of the College met in Chicago, June 18 at the time of the 14th Annual Meeting of the American College of Chest Physicians The activities of the College in Europe were discussed at this meeting and a resolution was adopted, praising Dr Gustav Maurer, Regent of the College for Europe, for the excellent work he has done in building the College membership Dr Lopo de Carvalho, the Governor of the College for Portugal, was also highly commended

One chapter of the College has been established in Europe, namely, the Greek Chapter which was organized in Athens in March 1946 The chapter has held several meetings at which time scientific papers were presented

At the present time there are 88 members and 11 applications pending in 19 European countries (Table VII) Most of the members in Europe have been admitted into the College during the past year A careful selection of applicants for Fellowship and Associate Membership in the College is being carried out by the officials of the College and it is hoped that those chest specialists who can meet the minimum requirements for either Fellowship or Associate Membership will be admitted to the College within the next few years Correspondence is being conducted between the officials of the College in Europe, the members of the College on European Affairs, and the Executive Offices of the College in accomplishing this objective

The exchange of College publications with various European medical journals have been expanded and medical books and reprints are now being received at the College library from our European members

TABLE VII
MEMBERSHIP — EUROPE

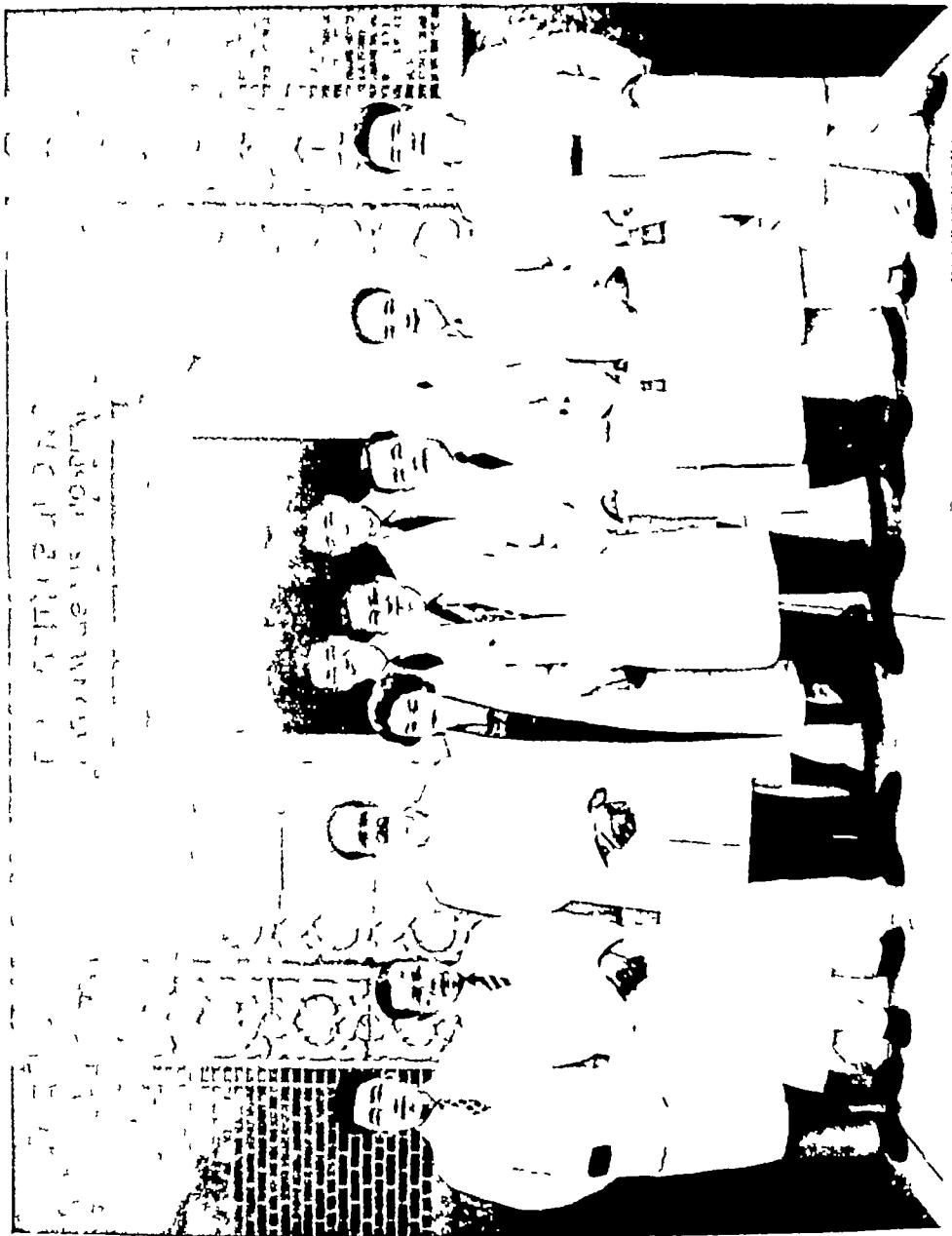
	Associate Members		Applications Pending Associate Members		Totals
	Fellows	Associate Members	Fellows	Associate Members	
Austria	1				1
Belgium	1	19	1		21
Czechoslovakia	1				1
England	2	7			9
France	2	8	1		11
Germany			2		2
Greece	4	10			14
Hungary	1				1
Ireland	2		1	1	4
Italy	2				2
Madeira Islands					1
Netherlands			2		2
Norway	1				1
Portugal	7	10			17
Scotland		1			1
Spain	1		1		2
Sweden	1		1		2
Switzerland	5	1			6
Yugoslavia	1				1
TOTALS	32	56	9	2	99

The College is participating in the conferences and congresses being held in Europe dealing with the specialty of diseases of the chest and reports of these conferences and congresses will be published in the College journal *Diseases of the Chest*."

Dr Andrew L Banyai the Chairman of the Council on European Affairs deserves much credit for the development of the European program.

Council on Pan Pacific Affairs

Harry C Warren M.D. San Francisco, California Chairman
 Miguel Canizares M.D., Manila Philippine Islands Vice-Chairman
 John S Bouslog M.D. Denver Colorado Secretary
 J Ancheng Miao M.D. Kunming China
 Indubhusan Basu M.D. Calcutta India
 Reeve H. Betts M.D., Brookline Massachusetts
 Robert E Duncan Capt. U.S.N., Corona California
 John B Fergusson M.D. Melbourne Australia
 James Hardie-Neil M.D., Auckland New Zealand
 W Elliott Harrison M.D. Vancouver B.C. Canada
 A. Holmes Johnson M.D., Kodiak Alaska
 Edna Mayer M.D., New York New York



Nine International Fellows now studying at the National Jewish Hospital at Denver Left to right are Dr Johnson C S Chu, Shanghai, Dr Cha Hsu Lan, Canton Dr Alberto Sanchez de Fuentes Havana Dr Marianne Oesterreicher London, Dr Jen-Heng Chen, Chungking, Dr Allan Hurst, Medical Director of the National Jewish Hospital at Denver Dr C T Hsing Nanking Dr Kwak In Sung Seoul Korea Dr Kuo Tsang Tientsin and Dr Nathan C T Chang of Soochow

Lincoln Pan M.D, Shaoshing, China
 Alan H Penington, M.D, Melbourne, Australia
 Li Shu Fan, M.D, Hong Kong, China

The Council on Pan Pacific Affairs held a meeting in Chicago on June 19, 1948 in connection with the annual meeting of the College. At the present time there are 90 members and 7 applications pending in the countries and territories in the Pan Pacific area (Table VIII)

TABLE VIII
 MEMBERSHIP — PAN PACIFIC

	Fellows	Associate Members	<i>Applications Pending</i>		Totals
			Fellows	Associate Members	
Alaska	2	1	1		4
Australia	14	12			26
China	5	5	5	1	16
Hawaii	13	6			19
India	12	4			16
Korea	1				1
New Zealand		1			1
Philippine Islands	14				14
TOTALS	61	29	6	1	97

Dr Warren presided at the meeting of the Council held in Chicago and stated that the purpose of the council was to bring together at such meetings the physicians who are interested in diseases of the chest in order to discuss matters of mutual interest as well as to be of assistance to the physicians in those countries ravaged by war or oppression. Dr Warren further stated that it should be impressed upon the minds of the members of the College that the appellation of F C C P should mean more than decorative initials. They should indicate membership in the largest international organization for the promotion of study and treatment of diseases of the chest and the improvement of educational facilities for the membership.

Dr Li Shu Fan detailed a harrowing and desperate condition of his country resulting from lack of medical personnel equipment and books in China. China has 12 medical colleges with about 2,000 students. The government support is meager, tuberculosis is rampant, the entire country is suffering from the ravages of 11 years of war and inflation. He suggested that the College investigate the possibility of our government permitting the admission of Chinese medical graduates to serve in our sanatoria as house officials, that they be given the opportunity to learn modern methods of tuberculosis therapy for a stipulated period and then be returned to their own country. Dr James T Cheng and Dr Tsai of Hong Kong, who attended the meeting as guests, stated that they are now engaged in such postgraduate study in the United States. Dr Alan Penington proposed that the Committee on Tuberculosis Hospitals of the College be asked to investigate the feasibility of offering

positions as house officers to medical graduates of China for specific periods

A resolution by Sir Sidney Sewell proposed that the Board of Regents of the College be asked to contact our federal government through our representatives in Congress to permit the entrance of such medical graduates to the United States for a specified period and that all such representations be made under the auspices and sponsorship of the American College of Chest Physicians

The Council on Pan Pacific Affairs of the College is pleased to report that since this meeting, a group of physicians from China have been admitted into the United States for postgraduate medical education under the auspices of the World Health Organization. A photograph of these physicians, who are now in training at the National Jewish Hospital in Denver, is made a part of this report

Dr John S Bouslog, the Secretary of the council, proposed that the College request its members to donate their surplus medical journals to a central or western location to be sent to the governors of the College in the Pan Pacific countries. It is respectfully requested that physicians who wish to donate books or journals should send them to Dr Harry C Warren, Chairman, Council on Pan Pacific Affairs, American College of Chest Physicians, 384 Post Street, San Francisco, California

Dr Cotter Harvey attended the College meeting in Chicago but was unable to be present at the meeting of the council

Activities of the College are progressing favorably in all of the countries within the jurisdiction of the Council on Pan Pacific Affairs of the College and the chairman and members of the council are to be congratulated upon this fine accomplishment

Council on African and Near East Affairs

Edgar Mayer, M.D, New York, New York, Chairman
 Moses J Stone, M.D, Boston, Massachusetts, Vice-Chairman
 Basil A Dormer M.D, Durban, South Africa, Secretary
 Zohora Ismail, M.D, New York, New York
 Charles K Nucho, M.D, Beirut, Lebanon
 Juda M Pauzner, M.D, Petach Tikva, Palestine
 Tevfik Saglam, M.D, Istanbul, Turkey
 Abdel-Aziz Sami, M.D, Cairo, Egypt

In order to complete the world organization in the specialty of diseases of the chest as formulated by the Council on International Affairs

TABLE IX
MEMBERSHIP — AFRICA AND NEAR EAST

	Fellows	Associate Members	Applications Pending		Totals
			Fellows	Associate Members	
Egypt	1				1
Lebanon	3				3
Palestine	1				1
South Africa	21	3		1	25
Turkey	1		1		2
TOTALS	27	3	1	1	32

of the College, it was necessary to establish a Council on African and Near East Affairs. The members of this council have recently been appointed and it is too early to report on their activities. However, we can mention that a chapter of the College was recently organized in Cape Town, South Africa on April 8, 1948 and it is anticipated that a second chapter will soon be organized for the northern states in South Africa. Activities in the other African and Near East countries will be carried forward by the council in compliance with the policies established by the Council on International Affairs. At the present time there are 30 members and 2 applications pending (Table IX).

Closing Remarks

The American College of Chest Physicians first became interested in building a world society of chest specialists in 1940. The leadership shown by the College in world affairs is now being followed by other medical societies. The accomplishments of the Council on International Affairs as set forth in this report is a record of which every member of the College may be proud. The members of the Council on International Affairs have guided the development of the international program of the College and their leadership has been an inspiration to those of us who were fortunate to work with them.

We are looking forward to the continued growth and progress of the College. We are pleased to announce that we are expanding our services to the members in the other countries by the acquisition of additional personnel in the executive offices of the College. Mr. S. N. Turiel has recently joined our office staff to assist in carrying forward this program.

We want to take this opportunity to express our thanks and appreciation to all of the members throughout the world for their splendid cooperation in helping to make this report possible.

Respectfully submitted,
Murray Kornfeld
Executive Secretary

Semi-Annual Meeting of Board of Regents

The semi-annual meeting of the Board of Regents of the College will be held at the Hotel Martinique, Miami Beach, Florida, on Saturday, October 23, just prior to the Sixth Annual Meeting of the Southern Chapter of the College which is also to be held in Miami Beach and Miami

The Regents and Governors of the College in the Southern States will hold a joint meeting at the Hotel Martinique at 10 00 a m on Sunday October 24

College Chapter News

SOUTHERN CHAPTER

The Sixth Annual Meeting of the Southern Chapter, American College of Chest Physicians, will be held in Miami, Florida, on Sunday, October 24 and Monday, October 25, in conjunction with the Southern Medical Association Headquarters for the Chapter will be the Martinique Hotel, Miami Beach, Florida

The program for the Southern Chapter will be as follows

Sunday, October 24, Martinique Hotel, Miami Beach, Florida

1 00 p m Registration, Southern Chapter

2 00 p m Scientific Session

Sydney Jacobs, M D , F C C P , New Orleans, Louisiana,
Chairman, Medical Section, presiding

"Aerosol Therapy of Bronchopulmonary Disease,"

Louis L Friedman, M D , F C C P , Birmingham, Alabama

"Two Year Follow-Up of a Mass Community-Wide X-Ray Survey,"

George W Comstock, M D , Columbus, Georgia

"Experimental Histoplasmosis,"

John Seabury, M D , New Orleans, Louisiana

"Pathology and Therapy in the Management of Cough,"

A Worth Hobby, M D , F C C P , Atlanta, Georgia

"The Use of Streptomycin in Tuberculosis,"

Samuel S Romendick, M.D , F C C P , St Louis, Missouri

6 30 p m Cocktail Party, Martinique Hotel

7 30 p m President's Banquet, Martinique Hotel,

Duane Carr, M D , F C C P , Memphis, Tennessee, Toastmaster

President's Address,

Herbert L Mantz, M.D , F C C P , Kansas City, Missouri

9 15 p m X-Ray Conference, Martinique Hotel,

Members and guests are invited to bring to the conference films of patients presenting unusual diagnostic problems Those cases which have been solved will offer the greatest interest and educational value to the membership at large, and will be called for first in the conference Unsolved cases on which consultation is desired will follow

Monday, October 25, Dinner Key, Miami, Florida

8 30 a m Registration, Southern Chapter, and Southern Medical Association

9 00 a m Scientific Session,
John S Harter, M.D, F C C P, Louisville, Kentucky,
Chairman Surgical Section, presiding

"Surgery in Congenital Heart Disease,"
Ralph Adams, M.D, F C C P, Woodbury, Tennessee

"Pulmonary Mobilization by Decortication,"
Thomas H Burford, M.D, St Louis, Missouri

"Physiological Significance of Bronchiectasis,"
Duane Carr, M.D, F C C P, Memphis, Tennessee

"Bronchogenic Carcinoma,"
Paul T DeCamp, M.D., New Orleans, Louisiana

12 30 p m Luncheon Meeting, Dinner Key,
Herbert L Mantz, M.D, F C C P, Kansas City, Missouri,
President, Southern Chapter, A C C P, presiding

Business Meeting, Southern Chapter

Election of Officers

Guest Speaker, Horace G Smithy, M.D, Charleston, S C,
"Surgical Treatment of the Constrictive Valvular
Diseases of the Heart"

During the remainder of the afternoon, members will be free to attend the scientific sessions of the Southern Medical Association, and to view the scientific exhibits at Dinner Key

Program Committee

David H Waterman, M.D, Chairman

Sydney Jacobs, M.D

John S Harter, M.D

Duane Carr, M.D

On Tuesday, October 26, a special meeting of the Cuban Chapter will be held in Havana. A scientific program will be presented at this meeting a copy of which is published elsewhere in this issue

Physicians who plan to attend the meeting of the Southern Chapter are urged to write at once to the Hotel Martinique for their reservations

SPECIAL MEETING OF THE CUBAN CHAPTER

Following the Sixth Annual Meeting of the Southern Chapter of the College, to be held in Miami Beach and Miami Florida on October 24-25 a special meeting of the Cuban Chapter will be held in Havana the evening of Tuesday, October 26. The Program Committee for the Cuban Chapter has arranged an interesting scientific program in which both United States and Havana physicians will participate.

The scientific program to be presented at this special meeting is as follows

Bronchography in Childhood Tuberculosis

Eduardo Rivero M.D and J M Rouco M.D, Havana Cuba

Discusor Louis L Friedman, M.D, F C C P, Birmingham Ala

The Surgical Treatment of Fallot's Tetralogy,

Antonio Rodriguez Diaz, M.D F C C P Havana, Cuba

"Cytology of Bronchopulmonary Secretions,"
Rafael Meneses, M D , Havana, Cuba

"Patent Ductus Arteriosus,"
Edgar W Davis, M D , F C C P , Washington, D C

"Some Immunological Considerations in Pulmonary Tuberculosis,"
Juan R Herradora, M D , F C C P , Jersey City, New Jersey
Discussor Carlos Varela, M D , Havana, Cuba

The Program Committee for the meeting is made up of the following College members in Havana Dr Rene G Mendoza, Chairman, Dr Gustavo Alderegula, Dr Jose G Airazuria, Dr Antonio Navarrete (Regent), and Dr Octavio Rivero (Governor)

All members of the College are cordially invited to attend this meeting Write to the Executive Offices of the College for transportation and hotel reservations Headquarters will be the Hotel Nacional in Havana, and the Hotel Martinique, Miami Beach, Florida during the meeting of the Southern Chapter

COLLEGE CHAPTER ORGANIZED IN URUGUAY

The Uruguayan Chapter of the College was organized at Montevideo on July 21, 1948, and becomes chapter number 34 of the College The first session of the new chapter was held in honor of Dr Chevalier L Jackson, Philadelphia, Pennsylvania, Chairman of the College Council on Pan American Affairs, who was visiting in Montevideo at the time The meeting was also attended by Dr Jose Silveira, Salvador, Brazil, Governor of the College for the Northern States of Brazil, and by Dr Alvaro E Bence, a member of the College from Buenos Aires, Argentina

The meeting was addressed by Dr Fernando D Gomez, Governor of the College for Uruguay, as well as by Dr Chevalier L Jackson, Dr V Armand Ugon, Dr Jose Silveira and Dr P Purriel

Officers of the new chapter were elected as follows

Victor Armand Ugon, M.D , President
Rodolfo Almeida Pintos, M D , Vice-President
Julio Cesar Barani, M D , Secretary-Treasurer

A dinner was also held at the time of the meeting for those present and a group photograph was taken The photograph will be published in a future issue of the journal

ULAST TO MEET IN MEXICO CITY

The Union of Latin American Tuberculosis Societies (ULAST) will hold its Eighth Congress in Mexico City, January 23-29, 1949 The American College of Chest Physicians has been invited to present a scientific program at the Congress and the preparation of the program is now under way The following College members have accepted invitations to participate in the program Dr Richard H Overholt, Brookline, Massachusetts, President of the College, Dr Chevalier L Jackson, Philadelphia, Pennsylvania, Chairman of the College Council on Pan American Affairs, Dr Jay Arthur Myers, Minneapolis, Minnesota, Past-President of the College and Editor-in-Chief of the College journal, Dr Leo Eloesser, San Francisco, California, Dr George G Ornstein, New York

City, Dr Seymour M Farber, San Francisco, California, and Dr Henry C Sweany, Chicago, Illinois

Mr Murray Kornfeld, Chicago, Illinois, the Executive Secretary of the College has been invited to attend the Eighth Congress of ULAST as guest of honor and has been requested to assist the committee in charge of the arrangements for the Congress

A breakfast meeting of all of the Regents and Governors of the College in the Latin American countries will be held during the Congress, at which time the program of the Council on Pan American Affairs will be discussed Dr Chevalier L Jackson, the Chairman of the Council will preside at this meeting

It is also planned to have a luncheon meeting at the time of the Congress to which all members of the College in attendance will be invited

The program activities presented by the Union of Latin American Tuberculosis Societies at this Congress will be of interest to all chest specialists and it is hoped that many College members in North, Central and South America will attend The Executive Offices of the College in Chicago will be pleased to assist members in making their hotel reservations and other arrangements

The College is also planning to arrange a tour for those members attending the Congress in Mexico City who might be interested in visiting Los Angeles and Hollywood after the close of the Congress The California Chapter of the College will be host at a dinner to be given in Los Angeles and arrangements will be made for a tour of the hospitals in the area A tour of the movie studios would no doubt be of interest to the visiting physicians and it is hoped that this can be arranged

Those physicians who wish to visit other cities in the United States will be assisted by the Executive Offices of the College in planning their itineraries

ARIZONA CHAPTER

At the annual meeting of the Arizona Chapter held at the Westward Ho Hotel, Phoenix, on May 19 the following officers were elected for the ensuing-year

Orin J Farness, M.D Tucson, President

Kent H Thayer, M.D, Phoenix, Vice-President

Leslie B Smith, M.D Phoenix Secretary-Treasurer (re-elected)

The new President, Dr Farness has announced the following committee appointments

Medical Education Committee

Daniel Mahoney M.D Tucson

Membership Committee

Edward J Nagoda M.D Tucson

Bertram L Snyder, M.D Phoenix

Program Committee

John W Stacey M.D Tucson Chairman

William B Steen, M.D Tucson

Benson Bloom M.D Tucson

MICHIGAN CHAPTER

The Michigan Chapter of the College will hold a dinner meeting at the Book Cadillac Hotel, Detroit, on September 23, in connection with the annual meeting of the Michigan State Medical Society. The following program is to be presented:

"Practical Consideration of the Diagnoses of Carcinoma of the Lung,"
Lawrence A. Pratt, M.D., F.C.C.P., Detroit

"Cytology of Carcinoma of the Lung,"
D. C. Beaver, M.D., Detroit

"A Modern Approach to the Management of Carcinoma of the Lung,"
William A. Hudson, M.D., F.C.C.P., Detroit

PENNSYLVANIA CHAPTER

The Pennsylvania Chapter of the College will hold its annual business meeting and 12-day conference at the Warwick Hotel in Philadelphia, on Monday, October 4. George G. Ornstein, M.D., F.C.C.P., New York, N. Y., has been invited to deliver a special address at the meeting.

ROCKY MOUNTAIN CHAPTER

The annual meeting of the Rocky Mountain Chapter will be held at the Colorado Hotel, Glenwood Springs, Colorado, on Wednesday, September 22. The program to be presented is as follows:

"The Diagnosis of Tuberculosis in Children,"
Ralph G. Rigby, M.D., Salt Lake City, Utah

"Diagnosis and Pathogenesis of Bullous Emphysema,"
Daniel W. Zahn, M.D., Fort Logan, Colorado

X-Ray Conference: Lantern slides of ten uncomplicated cases of diseases of the chest together with a brief history will be presented. Physicians in attendance will be requested to submit their opinions with regard to treatment of cases presented.

Luncheon—Business Meeting,
Guest Speaker: Richard H. Overholt, M.D., F.C.C.P., Brookline, Mass.,
President, American College of Chest Physicians

"The Use of Lucite as a Prosthetic Substance for Pulmonary Resection," Allan Hurst, M.D., F.C.C.P., and
John B. Grow, M.D., F.C.C.P., Denver, Colorado

"Bronchogenic Carcinoma—Why Have We Failed in Its Control?"
William R. Rumel, M.D., F.C.C.P., Salt Lake City, Utah

"Problems in Excisional Therapy in Chest Disease,"
Richard H. Overholt, M.D., F.C.C.P., Brookline, Massachusetts

WISCONSIN CHAPTER

The Fourth Annual Meeting of the Wisconsin Chapter of the College will be held at the Schroeder Hotel, Milwaukee, on Sunday, October 3. The following program will be presented at the meeting:

"Pneumonoconiosis Pulmonary Emphysema, and Cor Pulmonale"
Norbert Enzer, M.D., Milwaukee, Wisconsin

"Pulmonary Function in Bronchial Disease,"
Edwin R. Levine, M.D., F.C.C.P., Chicago, Illinois

"Bronchiectasis, Its Diagnosis and Surgical Treatment,"
William A. Hudson, M.D., F.C.C.P., Detroit, Michigan

"Comparison of Penicillin, Sulfadiazine, and the Combination of
Penicillin and Sulfadiazine in the Treatment of Lobar Pneumonia"
Italo F. Volini, M.D., F.C.C.P., Chicago, Illinois

"Fungus Disease of the Lung" (with motion picture demonstration),
Arthur Q. Penta, M.D., F.C.C.P., Schenectady, New York

"Pitfalls to the Early Diagnosis of Carcinoma of the Lung,"
C. Allen Good, M.D., Rochester, Minnesota

Registration will open at 1 30 p.m. and the scientific program will begin at 2 00 p.m. There will be a dinner meeting at 6 00 p.m. which will be addressed by Dr. Jay Arthur Myers, Minneapolis, Minnesota, Past-President of the College and Editor-in-Chief of the College journal. Dr. Myers will speak on the subject of "Protection of Medical and Nursing Personnel in Hospitals."

An X-Ray Conference will take place at 8 00 p.m. and this will be followed by an address on "Metastatic Tumors of the Lung" by Dr. Jerome L. Marks, Roentgenologist from the Milwaukee County General Hospital in Wauwatosa.

College News Notes

On Tuesday, July 6, 1948, Chevalier L. Jackson, M.D., F.C.C.P., Philadelphia, Pennsylvania, was awarded the degree of Commander of the Order of the Liberator San Martin (el grado de Comendador de la Orden del Libertador San Martin). This honor was bestowed on Dr. Jackson not only for his internationally known work in the field of laryngology but also for promoting understanding and good will between the United States and Argentina. The presentation was made by the new Argentine Ambassador, Jeronimo Remorino, at the Argentine Embassy, Washington, D. C.

Major General S. U. Marietta and Dr. J. Winthrop Peabody, Washington, D. C., Past-Presidents of the College, were present at the reception given at the Argentine Embassy on the occasion of the award.

During the latter part of July, Dr. Jackson participated in a post-graduate course in bronchoesophagology presented by the Faculty of Medicine of the Clinica de Otorrinolaringologia in Montevideo, Uruguay.

Dr. Jackson is the Chairman of the Council on Pan American Affairs of the College.

Rene G. Mendoza, M.D., Havana, Cuba, Vice-President of the Cuban Chapter of the College, has recently been appointed Director of the Sanatorio Anti-tuberculosis 'Angel Arturo Aballí' in Havana.

Merle D Bonner, M D , F C C P , Jamestown, North Carolina, Governor of the College for that state, was elected president of the North Carolina Tuberculosis Association at the annual dinner meeting of the Board of Directors of the Association

Marcio M Bueno, M D , F C C P , has been appointed Medical Director of the Tuberculosis Division, Fall River General Hospital, Fall River, Massachusetts Dr Bueno was formerly resident physician at the Sassaquin Sanatorium in New Bedford, Massachusetts

Herbert L Mantz, M D , F C C P , Kansas City, Missouri, was installed as President of the National Tuberculosis Association at their annual meeting last June Dr Mantz is a Regent of the American College of Chest Physicians and President of the Southern Chapter of the College

POSTGRADUATE COURSE IN DISEASES OF THE CHEST TO BE PRESENTED IN NEW YORK CITY

The American College of Chest Physicians and the New York Chapter of the College will present a postgraduate course in diseases of the chest to be held at the Hotel New Yorker, New York City, November 8 through 12, 1948 The course is being organized under the auspices of the Council on Postgraduate Medical Education of the College and Dr Frank R Ferlano, Secretary of the council, and Dr Edgar Mayer are in charge of the arrangements Some of the instructors who will participate in the course and the titles of their lectures are as follows

"Bronchiectasis Surgical Aspects,"
Arthur H Aufses, M D

"Bilateral Lung Rest (Chamber) Therapy in Pulmonary Tuberculosis,"
Alvan L Barach, M D , F C C P

"BCG Vaccine—Immunization Against Tuberculosis,"
Konrad Birkhaug, M D

"Early Tuberculosis,"
William G Childress, M D

"Bronchoscopy as an Aid in Diagnosis,"
Arthur J Cracovaner, M D

"Surgical Treatment of Pulmonary Tuberculosis,"
Louis R Davidson, M D

"Surgical Treatment of Pulmonary Tuberculosis,"
James S Edlin, M D , F C C P

"Pneumothorax Therapy,"
Walter L Evans, M D

"Industrial Diseases of the Lungs,"
Frank R Ferlano, M D , F C C P

"Allergic Manifestations in Pulmonary Disease,"
Joseph Harkavy, M D

"Epidermiologic Factors in Tuberculosis,"
John H Korn, M D

"Silicosis and Asbestosis,"
Anthony J Lanza, M D

"Resection for Pulmonary Tuberculosis "

Herbert C Maier, M.D

'Significance of the Wheeze in Bronchial Conditions

Edgar Mayer, M.D , F C C.P

'Carcinoma of the Lung,"

Foster Murray, M.D , F C C.P

'Use and Abuse of Bed Rest "

J Winthrop Peabody, M.D F C C.P

"Mycotic Diseases,"

Arthur Q Penta, M.D , F C C.P

"Applied Physiology in Pulmonary Diseases "

Richard L Riley, M.D

'X-Ray Interpretation of Pulmonary Diseases

Eli H Rubin, M.D , F C C.P

'Rehabilitation in Tuberculosis '

Howard Rusk, M.D

"Sarcoidosis "

Louis E Siltzbach M.D

"Pathology of Pulmonary Diseases "

David M Spain, M.D

' Streptomycin Treatment of Tuberculosis,

William H Stearns M.D

The Pathology Associated with Exposure to Beryllium "

Arthur J Vorwald, M.D

"Industrial Diseases of the Lungs '

George W Wright, M.D F C C.P

' Bronchiectasis Medical Aspects

William A Zavd, M.D

Drs Percy Eglee Grant Thorburn Edgar Mayer and Foster Murray will serve as moderators at the sessions and other members of the College are also being invited to participate as moderators for the course On Thursday evening November 11, a banquet will be given for the physicians registered in the course Dr Richard H Overholt Brookline Massachusetts President of the American College of Chest Physicians will be the guest speaker at the banquet

American College of Chest Physicians

500 North Dearborn Street Chicago 10 Illinois

Gentlemen I wish to apply for the course in diseases of the chest to be held in New York City November 8-12 Enclosed herewith please find my remittance in the amount of \$50 00

NAME

ADDRESS

CITY

STATE

Applications will be accepted in the order in which they are received

MEDICAL SERVICE BUREAU

POSITIONS WANTED

Physician from Bogota Colombia, now in the United States, desires opportunity to spend six months to one year in a sanatorium or clinic for the purpose of obtaining training in thoracic surgery Has knowledge of English language For further information please address Box 237A American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Ill Attention Overseas Dept

Young Austrian physician at present residing in Switzerland specializing in tuberculosis experienced in clinical and laboratory work, x-ray, tomography and thoracic surgery desires residency in the United States for one or two years in a sanatorium or clinic For further information please address Box 238A American College of Chest Physicians 500 N Dearborn St, Chicago 10 Ill, Attention Overseas Department

POSITIONS AVAILABLE

Position available Resident physician for tuberculosis sanatoria, experience available in all forms of collapse therapy Credit obtainable toward one years requirement for Board of Internal Medicine Located in resort area country, beautiful surroundings Exceptionally complete maintenance for self and family Within forty miles of two medical universities Salary dependent on experience Must have Michigan license For further information please address Box 181A American College of Chest Physicians 500 N Dearborn St Chicago 10, Illinois

Position open for a chief resident physician and a junior resident physician in an outstanding tuberculosis institution with over 200 bed capacity Salary including maintenance commensurate with experience and qualifications For further information please address Box 182A, American College of Chest Physicians 500 N Dearborn St, Chicago 10, Illinois

Physician in charge 60 bed institution, capable of assuming responsibilities of an active medical and surgical service Salary depends on experience and ability and includes maintenance For further information please address Box 185A American College of Chest Physicians 500 N Dearborn St Chicago 10 Ill

Pathologist interested in the development of a research program Duties include routine and special laboratory work relating to diseases of the chest Salary commensurate with ability includes maintenance For further information please address Box 186A American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Illinois

Resident physician good salary and maintenance Prefer young man with family For further information please address Box 187A American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Illinois

Young man to associate in private chest practice, about half tuberculous, half non-tuberculous Must be well trained either medically or surgically Reply at once Please address Box 188A, American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Illinois

Physician wanted, experienced in pneumolysis bronchoscopy, pneumothorax and also to assist a thoracic surgeon Salary commensurate with experience Hospital in Pacific Northwest, full maintenance furnished residence for family For further information please address Box 190A, American College of Chest Physicians, 500 N Dearborn St, Chicago 10, Illinois

Resident staff physician desired at state sanatorium for pulmonary tuberculosis, 500 bed capacity, annual salary up to \$7,000, depending on qualifications and experience Comfortable quarters available For further information please address Superintendent, South Carolina Sanatorium, State Park, S C

Wanted, physicians with specialization in tuberculosis Starting salary \$5040 \$6180 or \$7920, according to qualifications, with possible advancement to \$9120 a year Civil service tenure and pension retirement Must have Michigan license or be able to obtain one Apply Michigan Civil Service Commission, 200 North Grand, Lansing, Michigan

Medical officers wanted for Glenn Dale Sanatorium, the tuberculosis sanatorium for the District of Columbia Salary range from \$4902 to \$5905 per annum Sick leave, annual leave, and retirement benefits One year's experience in tuberculosis required Address inquiries to Superintendent, Glenn Dale Sanatorium, Glenn Dale, Maryland

DISEASES of the CHEST

VOLUME XIV

NOVEMBER-DECEMBER 1948

NUMBER 6

Facts and Fancies in the Management of the Seriously Ill Patient with Bronchial Asthma*

MAURICE S. SEGAL, M.D., F.C.C.P.**

Boston, Massachusetts

Contrary to the pessimistic view frequently expressed by the patient and his friends, considerable benefit can be given to the very sick asthmatic by the application of procedures to be discussed. These measures are based largely on personal experience in the management of 513 patients with severe bronchial asthma and have been correlated with extensive laboratory studies with a large variety of protecting drugs employing a method of human assay to be described. I have attempted to illustrate (Fig 1) the various measures which are necessary to balance the delicate therapeutic seesaw of the sick asthmatic subject and will limit myself to a discussion of the more important

Protecting Drugs Correlation of Laboratory and Clinical Data

Two substances (histamine and acetylcholine) have been considered possible chemical mediators of allergic phenomena. Both of these substances are capable of producing dyspnea and bronchospasm in asthmatic subjects and may be used in the evaluation of drugs capable of protecting against these effects.^{1,2} With this technique, a method of human assay of the relative value of new and accepted therapeutic agents^{3,4,8,9,10} for the relief of bronchial asthma has been evolved.

A protection study consists of determining the effect of a bronchospastic agent on vital capacity of the lung (Fig 2) before and

*From the Department of Inhalational Therapy, Boston City Hospital and the Department of Medicine, Tufts College Medical School.

**Director, Department of Inhalational Therapy, Boston City Hospital; Assistant Professor, Department of Medicine, Tufts College Medical School.

Presented at the 14th Annual Meeting of the American College of Chest Physicians, Chicago, Illinois, June 20, 1948.

at twenty to thirty minute intervals after the administration of a protecting drug (drug under investigation) The resultant decreases in vital capacity are compared to the control drop "Protection" was demonstrated when the administration of histamine or mecholyl chloride caused either no drop in vital capacity or a drop distinctly less than the control amount Protection was lost when the decrease was once again equal to the control drop

Any one protection study in a single individual may have little general relevancy The degree of protection is expressed in terms applicable to many subjects so that the data may be massed into averages of greater statistical value^{10 11} During a period of protection, the decrease in vital capacity produced by the same dose of bronchospastic agent will, by definition, be less than the control drop The percentage difference between these two values represents the measure of protection For our calculations, we have used the following equation $P=100 (C-E)/C$ P represents the percentage of protection (100 per cent indicating absence of any decrease in vital capacity after an injection of histamine or mecholyl chloride) C, the control drop, and E, the decrease similarly produced at any given time after the protecting drug has been administered Each curve represents the average result of a minimum of several studies according to the above formula

We have employed, by aerosol as well as by intravenous route,

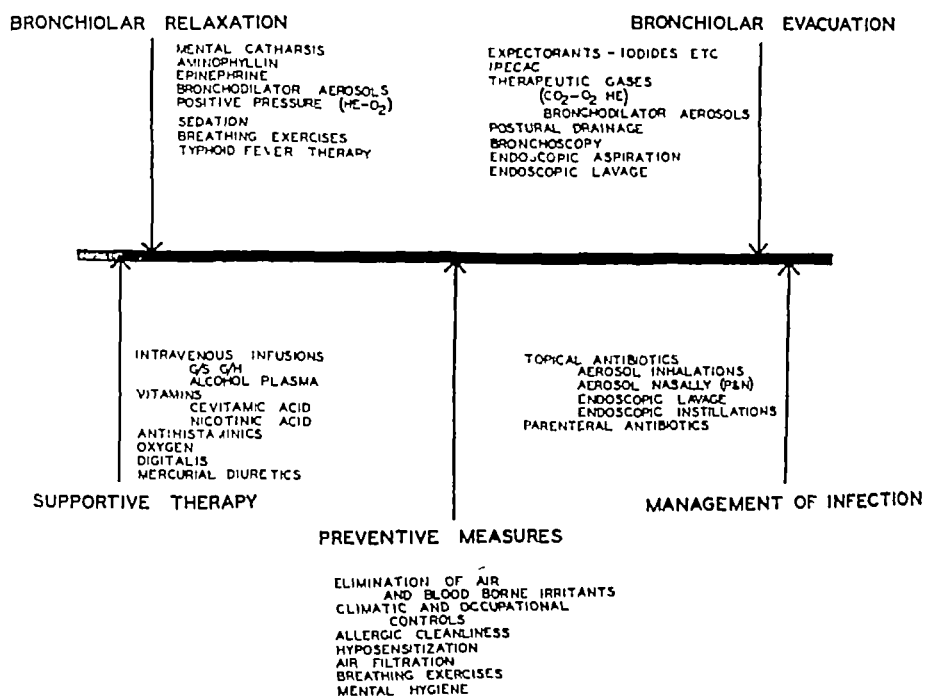


FIGURE 1 CHART

histamine, acetyl-beta-methylcholine and allergenic extracts as bronchospastic agents. With this human assay method, we have investigated various classes of drugs including anticholinergic agents,¹² adrenergic agents,¹³ aminophyllin¹⁴ by all possible routes, antihistaminic agents¹⁵ Cytochrome-C, Khellin and a number of other miscellaneous drugs. We have obtained statistically valuable data describing the degree of protection afforded by a given protecting agent against a bronchospastic drug. This technique has afforded us the opportunity of making these studies under controlled conditions usually not present in the sick patient. Some of these observations will be discussed briefly.

It would appear from this data that the combination of a good antihistaminic and a good anticholinergic drug would be an ideal therapeutic agent in bronchial asthma. Two drugs, aminophyllin and epinephrine, are very valuable in the management of the asthmatic. According to our laboratory data, epinephrine is a good antihistaminic and anticholinergic agent and also works very well in clinical asthma. Aminophyllin,¹⁴ on the other hand, is a fair antihistaminic but a poor anticholinergic agent. Nevertheless, it is excellent for the clinical management of the asthmatic patient at certain intervals in his illness. When it fails, for instance, in certain stages of status asthma, one may infer perhaps that an excess of choline is present at that particular moment. We have also been able to demonstrate with many of the new antihis-

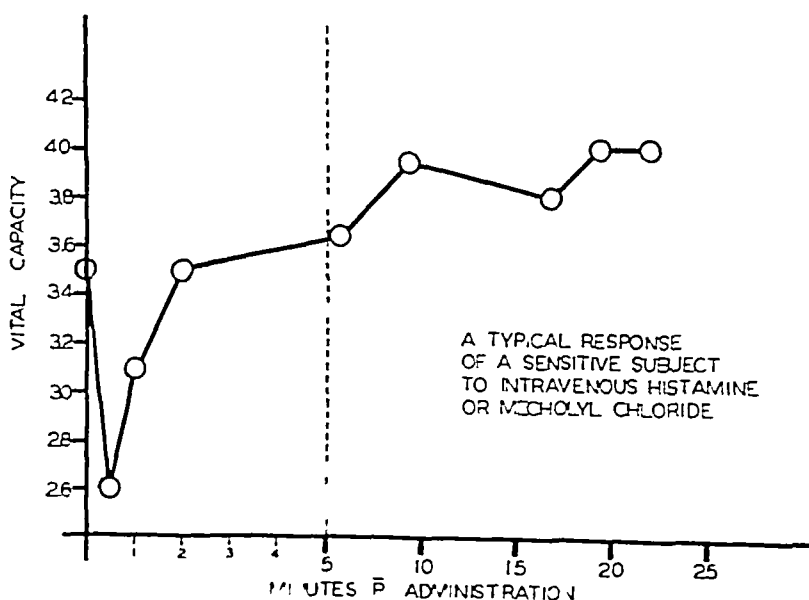


FIGURE 2

Typical drop and restoration of vital capacity after the administration of intravenous histamine or mechohyl chloride to an asthmatic subject

taminic¹⁵ preparations excellent protection against histamine-induced dyspnea and bronchospasm in asthmatic subjects Yet, for the most part, these agents have very limited value in the management of the sick asthmatic when administered orally

Parasympatholytic agents,¹² particularly atropine, scopolamine and Bellofoline, have demonstrated excellent anticholinergic protection in our laboratory The central sedative effects of hyoscyne and hyoscyamine are very desirable However, the drying effect of these alkaloids on the mucous membranes of the tracheobronchial tree may lead to further inspissation of the already semi-solid mucus plugs, making coughing and their expulsion more difficult These untoward effects may lead to further asthma, atelectasis or asphyxia These anticholinergic agents may be of some value in the depleted sick asthmatic who is hypotensive and sweating profusely, and may be considered to exhibit a systemic picture of parasympathetic stimulation

Because of the tremendous interest in the various bronchodilator aerosol preparations, we undertook a comparative study of the protective abilities of Vaponefrin aerosols (racemic methyl amino-hydroxy-ethyl-dihydroxy-benzene HCl), Isuprel^{17 18} (1-(3' 4' Dihydroxy-phenyl)-2-isopropylaminoethanol) and epinephrine 1 100 against the effects of intravenous histamine, and mecholyl-induced dyspnea and bronchospasm in asthmatic subjects

Epinephrine aerosol 1 100 demonstrated 75 per cent immediate protection against the effects of histamine This degree of protection was short lived and at the end of ten minutes had dropped to below 40 per cent, the level we consider significant Its protection against the effects of mecholyl was less marked, ranging from immediate protection of 56 per cent to 40 per cent at the end of ten minutes Vaponefrin aerosol demonstrated 93 per cent immediate protection against the effects of histamine Moreover, this degree of protection wore off more gradually than with 1 100 epinephrine and significant protection (40 per cent) was still present at the end of twenty-seven minutes Its protection against the effects of mecholyl was less marked than against histamine, ranging from immediate protection of 70 per cent to 40 per cent at the end of ten minutes Thus, Vaponefrin demonstrated greater immediate and more prolonged protection against the effects of histamine and mecholyl than aerosols of epinephrine 1 100

Isuprel 1 200 demonstrated 70 per cent immediate protection against the effects of histamine This protection dropped to 40 per cent at the end of twenty minutes Surprisingly, it proved to be of greater protecting value against the effects of mecholyl, 70 per cent immediate protection dropped slowly to 40 per cent at the end of forty minutes Thus Isuprel 1 200 demonstrated more

prolonged protection against the effects of mecholyl than either 1 100 epinephrine or Vaponefrin, but less immediate and prolonged protection against the effects of histamine than either 1 100 epinephrine or Vaponefrin Isuprel 1 100 demonstrated excellent immediate protection (90 to 100 per cent) against the effects of both histamine and mecholyl This protection against the effects of mecholyl and histamine dropped gradually to 40 per cent at the end of seventy-five and sixty minutes respectively Thus Isuprel 1 100 proved to be the most effective agent for protection against the effects of histamine and mecholyl in the laboratory However, the concentration of 1 100 Isuprel is too prone to produce disturbing side reactions for routine clinical use

These laboratory studies confirm what we have previously^{17 18} reported in the clinical management of the asthmatic subject Both Isuprel 1 200 and Vaponefrin are effective bronchodilator aerosols with powerful immediate bronchospasmolytic properties, albeit short-lived Isuprel offers the best protection against the effects of acetylcholine, Vaponefrin the best against the effects of histamine Clinically one patient's asthma frequently responds better to one of these drugs than the other The reverse order of efficiency may be true in the same patient at another time Refractoriness to both drugs may develop but loss of sensitivity to one is not transferable to the other Individual tolerance also varies Both of these drugs have a valuable place in the therapeutic seesaw and the clinician can determine by careful observation the need for one or another of these drugs

Drug Tolerance

The incidence of true drug allergy (idiosyncrasy) is considerably higher in asthmatics than in normal subjects Furthermore, sensitization may occur following the second administration of a drug after an interval of one to four weeks This is particularly true of pontocaine,¹⁹ and many of the serious reactions and deaths observed have occurred with second usage at the time of repeat bronchoscopy or bronchography

Certain drugs, particularly opium and morphine, should be avoided Other drugs such as aspirin, quinine, quinidine, pontocaine, cocaine, sulfonamides, penicillin inhalations, intravenous sedatives (particularly sodium pentathol which may produce bronchospasm) and intravenous sclerosing agents, should be used with caution Accidental intravenous injection of drugs or allergenic agents^{20 21} may also explain sudden collapse and death Even idiosyncrasy to iodides may be occasionally observed

The majority of patients in status asthma soon become intolerant of most drugs—witness the frequency of nausea, vomiting, rest-

lessness, itching of the skin and nose, rashes and edema of the lips No true sensitivity to adrenalin or aminophyllin has been reported, however toxic reactions and intolerance to both of these drugs may occur Furthermore, deaths²²⁻²⁴ have been reported attendant with their use intravenously

Sedation

It is best to avoid heavy sedation, as the incidence of obstructive asphyxia and pulmonary edema is highest in the heavily sedated patient Agents should be used which have a wide margin of safety The barbiturates and morphine lower the threshold of the respiratory center until it is less sensitive to stimulation than normal Barbiturates on the whole are disappointing

If one must use the barbiturates or morphine pre- or post-operatively, it is best to administer supplementary oxygen I have found the combination of chloral hydrate and sodium bromide of particular value in the management of the patient with status asthma This combination can be given rectally in doses of from 1 to 3 gm each and may be repeated at twelve hour intervals for several days without fear of serious depression resulting

Now a word about morphine—occasionally one sees a very striking result with the initial use of morphine—e.g. 1/6 or 1/8 gr subcutaneously With repeated doses, however, serious sequelae may follow I prefer to avoid the use of morphine in all asthmatic patients On the whole, morphine tends to depress the respiratory rate and diminish the tidal volume, thus increases the degree of hypoxia, decreases the cough reflex, prevents getting secretions up and out, and tends to increase bronchospasm In addition, there is always the possibility of hypersensitivity and addiction to the drug itself

In the laboratory, we have found demerol²⁵ a fair anticholinergic drug Scopolamine (levorotatory hyoscine) has a stronger action than atropine on the secretory glands and has a more marked central sedative effect It has proven to be an excellent anticholinergic drug¹² when administered subcutaneously A combination that we have found effective clinically is demerol 100 mgm and scopolamine 0.3 mgm—which leads to a modified form of "twilight sleep" However, I would suggest that this combination be used with some caution I would avoid its use entirely in the dry asthmatic In the wet asthmatic, it may be attendant with striking success when first given, but it should not be repeated more than a second time in a twenty-four to forty-eight hour interval

A word about anesthetic drugs—it is best to realize that all inhalatory anesthetics may produce bronchospasm The mech-

anism of bronchial relaxation with anesthetic agents is not entirely certain. It is possible that the mental and physical relaxation permits, by some reflex mechanism, bronchial relaxation.

Ether administered rectally in doses of from 2 to 3 ounces in equal amounts of oil may be given every fifteen minutes or every half hour to produce anesthesia. The asthmatic should not be heavily sedated or anesthetized during routine treatment. Personally, I prefer doses of 3 to 5 ounces at eight hour intervals for two or three days, if necessary. Relief from intractable asthma frequently follows the state of relaxation and great expectoration induced by the ether. I have not found ether in oil by intramuscular injection of any value. Barach²⁶ has called our attention to the synergistic relaxing effects of helium and oxygen breathing and rectal ether. Furthermore, one may frequently observe restoration of epinephrine sensitivity in the epinephrine-fast subject after he has been so treated. The open drip method may be resorted to on rare occasions.

Paraldehyde Paraldehyde should be used as an amnestic or hypnotic rather than as an anesthetic. It is best not to administer paraldehyde intravenously, for deaths have been reported with this route.²⁷ Paraldehyde should also be avoided intramuscularly because of the danger of accidental venous puncture and the possibility of ensuing cellulitis and abscess formation following the use of 8 or 10 cc of this drug. I have found the rectal route the safest and best tolerated. Paraldehyde may be administered rectally at twelve hour intervals in doses of 20 to 30 cc combined with either equal amounts of olive oil or in a cornstarch paste. Similar doses, prepared in iced lemonade may be given orally. However, many object to the taste and smell. Rebreathing of the volatile paraldehyde should be prevented by the sick or moribund patient. Frequently, following the rectal use of paraldehyde and/or ether, coughing or the sudden increased flow of mucoid secretions may be invoked—generally to the patient's benefit.

To complete the subject of sedation and anesthetic drugs, I should again like to add a word of caution about the use of sprays or topical pontocaine and cocaine, particularly keeping in mind the latent period of sensitization of one to four weeks. Serious reactions or fatalities may follow second usage (particularly of pontocaine). Skin testing should be done before using these drugs. The preliminary use of barbiturates and antihistaminics may minimize the extent of the reaction. Epinephrine and aminophyllin must be available for immediate administration. Finally, an aminophyllin infusion should be given prophylactically to all patients who are about to receive pontocaine or cocaine, for a second time within a one to four week period.

Supportive Therapy

The sick asthmatic presents a rather serious picture of total physiologic deprivation. Evidence of severe anoxia, cyanosis, dehydration, peripheral vascular shock and drug intoxication from intensive therapy may be present. He has been ill for some time and has lost a good deal of fluid and electrolytes. The first effort should be to replace this lost material. No fixed rules should be set up for the contents of this so-called "intravenous cocktail." It is generally my custom to begin by using 5 per cent glucose in saline for the first liter and 5 per cent glucose in distilled water for the second and third liters. The three liters may be given in twenty-four hours by employing a flow of approximately 30 drops per minute.

In the young patient, wherein the possibility of cor pulmonale and underlying heart disease does not present itself, one can safely give more saline solution. In the rare patient with a complicating cor pulmonale, the judicious use of a salt-free diet, distilled water in place of saline for the "infusion cocktail" and daily use of 2 cc intramuscularly of one of the mercurial diuretics has been of life-saving value.

I have not been able to convince myself of the value of digitalis in most of these patients. The occasional patient appears to be helped but some are even further incapacitated.

Aminophyllin (theophylline ethylenediamine) in varying dosage may be added to the intravenous infusion. Theophylline has been demonstrated to release bronchial spasm and to lower the venous and intrathecal pressures. Patients vary in their tolerance to aminophyllin—some become alerted, others become drowsy, many become nauseous and may even vomit, and still others complain of palpitations and sweating. Syncope and peripheral vascular collapse may be observed if the injections are too rapid. Some of these reactions may be avoided by slowing the rate of flow. One may begin by adding 0.5 gm of aminophyllin per liter of solution. The dose may then be adjusted lower or upward to 1 gm per liter of solution depending upon the patient's ability to tolerate the drug. How long should one continue to use intravenous infusions? They may be run continuously for one day or longer. Goodall and Unger²⁸ have been able to relieve many severe attacks with continuous intravenous aminophyllin in glucose or saline solutions. I have continued them for as long as ten days. The duration should depend upon the patient's response and tolerance to aminophyllin. If improvement follows one or two days of continuous therapy, the intravenous infusions may then be given intermittently, e.g., from 9 a.m. to 9 p.m. daily, reducing the total

intake to 1500 cc Supplementary aminophyllin, if necessary through the night, may be given in the form of a 20 cc intravenous solution containing 0.25 or 0.50 gm aminophyllin This should be administered slowly at a rate not exceeding 2 cc per minute Intramuscular aminophyllin (2 cc ampoule containing 0.5 gm) has a very limited value clinically and furthermore patients complain of pain during its administration and of residual soreness and "lumps"

The continuous or interrupted infusions may be omitted with evidence of complete freedom from severe paroxysms of coughing or bronchospasm In their place, aminophyllin should then be administered rectally in dosage of 5 to 10 grains in 15 cc of tap water every eight or twelve hours This therapy, in gradually diminishing dosage, should be continued for at least one month after complete recovery

In time, the rectal aminophyllin solution may be replaced with a tablet containing aminophyllin 0.2 gm, ephedrine sulfate 0.025 gm (or suitable derivation) and phenobarbital 0.03 gm administered upon arising and at 4 p.m. if indicated The phenobarbital serves as an efficient sedative with a slow onset and prolonged action capable of offsetting the stimulatory effects of aminophyllin and ephedrine A tablet containing aminophyllin 0.3 gm, ephedrine sulfate 0.04 gm, sodium pentobarbital 0.1 gm, and phenobarbital 0.06 gm, may be administered at bedtime for prompt and protracted hypnotic action

Other therapeutic agents may be added to the "intravenous cocktail" Cevitamic acid in high dosage or cytochrome C may be given intravenously in the hope that they will increase the oxygen uptake from the blood plasma into the red cells themselves However I have not seen any striking results from their use, although I have given as much as 5000 mg of cevitic acid per liter of solution The same holds for nicotinic acid intravenously One may observe an extensive flush and perhaps some bronchial dilatation but no lasting effects Furthermore, the side reactions of flushing, warmth and throbbing headaches are not well accepted by most patients although they were forewarned of same I should like to suggest avoiding the use of Vitamin B Complex preparations intravenously because of sensitization to thiamine chloride If there is definite evidence of Vitamin B deficiency, they may be given intramuscularly

On occasion, alcohol-dextrose solution may be given intravenously in place of the saline-dextrose infusions Brown,²⁹ and Brown and Gillespie³⁰ have reported excellent results with infusions of 5 per cent ethyl alcohol in glucose or saline, with or without epinephrine in the solution We have generally employed one liter

of 5 per cent ethyl-alcohol in 5 per cent glucose solutions free of vitamin supplements. When necessary, aminophyllin was added to this infusion. Flows of 80 to 120 drops per minute are generally necessary for relaxation. Excitement may follow too rapid rates and relaxation may occur with slow rates, this is due to excessive or inadequate cerebral blood levels respectively. We have occasionally seen striking relaxation when the mixture was given for the first or second time. As a rule, however, these effects did not persist with repeated use. The peripheral vasodilatory effects could be deleterious in the presence of peripheral vascular collapse and further limits the usefulness of this mixture.

We have observed in this series of cases, three instances of serious peripheral vascular collapse characterized by ashen-colored, cold and clammy skin, rapid and barely perceptible heart rate and dropping blood pressures. These patients were given blood plasma with very good effect. Two patients required two units respectively and the third patient received eight units in twenty-four hours before recovering from the profound shock. The sternal route had to be employed with the latter patient because of inability to locate the collapsed veins when death appeared imminent. Supplemental oxygen, intravenous neosynephrin, cevitic acid and adrenal cortical extract were also employed in these patients and recovery was complete.

Epinephrine

Epinephrine has proven to be both a good antihistaminic and anticholinergic drug in experimentally induced dyspnea and bronchospasm in our laboratory. This drug has been employed in various modifications and concentrations and routes. No true idiosyncrasy (allergy) to epinephrine has been reported. However, toxic reactions, intolerance and fastness may occur. These effects are more commonly observed with overdosage and with repeated parenteral use. Deaths^{22 31} have been reported following intravenous administration or accidental intravenous injection, these may have been due to epinephrine deposit in the heart muscle with ensuing ventricular tachycardia and fibrillation³². Caution should be stressed about the possibility of accidents from the injection of 1:100 epinephrine and other concentrated sympathomimetic amines intended purely for aerosol use.

In general, epinephrine parenterally is limited in its value for the relief of the acute attack. The minimum dosage which will accomplish the desired effect is the best for it will also minimize the disagreeable side reactions. Unfortunately, few limit the dosage to the proper and effective subcutaneous injection of 0.2 to 0.3 cc of 1:1000 dilution. Generally, larger doses at frequent intervals

are resorted to Unfortunately, the use of the hypodermic injection, which should be avoided, is encouraged too often for self-medication Habitual users of self-administered hypodermics of epinephrine become dependent upon this crutch The despair of the disease is further contributed to by this dependency The epinephrine-fast state is encountered most commonly in these patients I have not observed any striking value from combinations of epinephrine 1:500 in various oil and gelatin vehicles employed for a slow release Uncertainty of uniform absorption and action due to the sudden release of epinephrine, the side reactions, the residual soreness due to poorly resorbed tissue areas, and possible oil tumors limit its value Most patients in status asthma are epinephrine-fast, and the use of all epinephrine preparations should be avoided for at least several days until epinephrine sensitivity is restored I have made a rule of never adding epinephrine to the "intravenous cocktail" for these patients with status asthma

The development of the epinephrine-fast state in the asthmatic subject is distressing to the patient and poorly understood by his physician The delicate histamine-sympathin balance or seesaw is upset Repeated injections of epinephrine no longer produce bronchial relaxation, but rather manifestations of toxicity—namely palpitations, tachycardia, headache, flushing, etc Staub³³ and Farrerons-Co³⁴ have demonstrated that epinephrine invokes the production or release of histamine in the experimental animal (probably as a homeostatic effort) Yonkman,³⁵ and Yonkman and Mohr³⁶ thought that these studies probably explained in part the mechanism involved in the potentiation of adrenergically controlled functions by antihistaminic agents, and, furthermore, that this histamine release could paradoxically contribute to further broncho-constriction, pulmonary edema and dyspnea This sequence may be more evidenced in the allergic than in the normal subject They suggested that antihistaminic preparations given intravenously could be of value in serving as histamine antagonists or epinephrine spacers in the epinephrine-resistant patient, thus balancing the delicate histamine-sympathin seesaw These studies by Staub, Farrerons Co, and Yonkman and Mohr are of particular interest in view of our recent observations in two acutely ill patients in status asthma A prompt restoration of epinephrine sensitivity followed the intravenous injection of 50 mgm of an antihistaminic in both of these subjects

The use of ephedrine preparations for the relief and prevention of asthmatic attacks has many limitations They are of no value in the acutely ill patient Side reactions, notably palpitation, headaches jitteriness and insomnia, are quite common In the

middle-aged male patient, urinary difficulties, particularly dysuria and diminution of the urinary stream, may appear. However, preparations employing 0.25 to 0.5 grains of ephedrine sulfate or similarly acting drugs combined with aminophyllin and sedative preparations are beneficial as supplementary therapy for the ambulatory patient. Several of the newer ephedrine-like synthetic drugs may cause less side reactions to occur. One of these preparations, Orthoxine (Upjohn), has been well tolerated in 200 mg doses at four hour intervals and has appeared to help some patients.

Therapeutic Use of Gases

Oxygen should be employed for the relief of anoxia and cyanosis, helium and oxygen mixtures for the relief of respiratory obstruction, positive pressure inhalations of oxygen or helium and oxygen for the management of pulmonary edema, carbon dioxide mixtures as expectorants ("bronchial catharsis"), and aerosols of bronchodilator drugs for the relief of bronchospasm or antibiotic drugs for the control of infection.

1 Oxygen and Helium-Oxygen Mixtures

The inhalation of helium and oxygen mixtures³⁷⁻⁴¹ have relieved many patients who failed to respond to other recognized therapeutic measures. *The type of gas mixture used will depend upon the factors responsible for the dyspnea, whether hypoxia or respiratory obstruction.* If hypoxia is the main factor oxygen in adequate concentrations, employing equipment most suitable for the patient, should be administered.

Barach⁴²⁻⁴³ has demonstrated that if respiratory obstruction exists, mixtures of 80 per cent helium and 20 per cent oxygen are more beneficial than oxygen alone. The percentages of the helium and oxygen mixtures can be controlled at will by using separate tanks of oxygen and 80 per cent helium with 20 per cent oxygen connected by a Y tube to the apparatus used. The greater the concentration of helium (66 to 80 per cent), the more effective the mixture in overcoming respiratory fatigue and dyspnea, provided that hypoxia is avoided.

It may be observed that positive pressure inhalation of oxygen or helium and oxygen will clear up signs of pulmonary edema promptly. The patient can be treated in the hood apparatus or positive pressure mask⁴¹ intermittently for as many days as necessary. Positive pressure therapy should be intermittent and generally for one hour out of every four hours as the patient may find it tiring for longer periods. It is better tolerated in the hood apparatus.

2 Carbon Dioxide-Oxygen and Carbon Dioxide-Helium-Oxygen Mixtures

A dry, irritating, non-productive or poorly productive cough is frequently encountered in asthmatic subjects. Every attempt should be made to reduce the viscosity of the exudate by the usual expectorants or by the use of therapeutic aerosols, carbon-dioxide and oxygen mixtures, or carbon-dioxide and helium-oxygen mixtures.

Banyai,^{44, 45} Hollinger^{46, 47} and others have found inhalations of CO₂ and O₂ superior in therapeutic action to expectorants. Inhalations of carbon-dioxide-oxygen mixtures should be employed only if the more conservative measures have failed and if there are no contra-indications particularly emphysema, to increasing the rate and depth of respirations, albeit for short periods of time. I have found mixtures of 5 per cent carbon-dioxide, 20 per cent oxygen and 75 per cent helium of particular value when employed to nebulize mixtures of 0.25 cc of 1 per cent neosynefrin with 0.50 cc of Vaponefrin or Isuprel, 1:200, this has been generally well tolerated. Each treatment should take five to ten minutes and should be interrupted frequently if the respirations become too strenuous. A harsh, useless, ineffective cough may be converted into a useful one that produces mucopurulent exudates.

3 Therapeutic Aerosols

Inhalation of nebulized sprays of various therapeutic agents may be employed for the relief of the troublesome cough as an aid to expectoration and for the control of infection. Aerosols of Vaponefrin, Isuprel 1:200 or Epinephrine 1:100 are of particular value for the relaxation of bronchospasm. Nebulization (with the hand bulb, continuous flow of oxygen or helium-oxygen, or air-pump (Fig. 3) of 0.5 to 1.0 cc of these solutions generally overcomes the bronchospasm. It likewise often converts a useless cough, improves the vital capacity and permits deeper respirations. The combination of 0.5 cc of Vaponefrin or Isuprel 1:200 and 0.5 cc of 1 per cent neosynephrin is of particular value when there is bronchospasm accompanied by sticky, tenacious sputum or a troublesome unproductive cough. Substituting helium and oxygen mixtures for oxygen is of further value if there is evidence of bronchial obstruction. The helium-oxygen mixture allows the nebulized solutions (Vaponefrin, neosynephrin, penicillin or streptomycin) to pass through contracted bronchi more freely and permits these preparations to act effectively on the mucosal and submucosal surfaces.

The sympathomimetic aerosols should be employed only when

specifically indicated and with well defined instructions to the patient and nurse. The proper inhalatory technique with the use of a small particle size nebulizer is most important. The preparations should be clearly labeled by name and concentration, and marked for *aerosol use only*. On occasion, they have accidentally been given parenterally with very disturbing side reactions. Excessive use should be firmly prohibited. The patient must be instructed not to swallow saliva during treatment, and to rinse his mouth thoroughly after each treatment. With overdosage, the usual side reactions observed with epinephrine may be seen. Finally, the patient should be taught to wait fully five minutes after one to three inhalations before repeating same.

Bronchial Evacuation—"Catharsis"

Evacuation of the bronchi may be accomplished by "bronchial catharsis," positional drainage, bronchoscopic aspiration and endoscopic lavage. Catharsis in the Freudian sense may be of value in the management of the sick asthmatic. In its physiologic significance, it is frequently of life-saving value. Bronchial catharsis may be accomplished in a variety of ways. The expectorant drugs (e.g., iodides⁴⁸) may be considered bronchial evacuants. Ipecac is



FIGURE 3 AIR PUMP*

For the production of aerosols with the standard nebulizer technique (bronchodilator drugs), rebreathing technique (antibiotic drugs) and with venturi (positive and negative pressures for para-nasal sinus disease)

*Vaponefrin Company Upper Darby Pennsylvania

probably the most effective agent that can be employed to promote bronchial evacuation

Expectorant drugs play a very important role in the management of the sick asthmatic. The mucus in the bronchioles is usually tenacious and inspissated, due largely to dehydration and long residence because of ineffectual cough. Many expectorants and expectorant sedative mixtures have been employed, the most commonly employed being the iodides and ammonium chloride. I have never been certain of any benefit from compound tincture of benzoin and prefer the volatile oils of anise, pine and eucalyptus in steam for their expectorant action.

I have found ipecac of considerable value in the management of various stages of bronchial asthma in adults. The patient should be able to withstand the retching associated with reverse peristalsis. *Ipecac acts by substituting effective retching in the place of ineffective coughing.* It is always worth a trial before attempting bronchoscopy. Once the "tracheal vomiting" (Reinberg⁴⁹ and Ratner⁵⁰) has started, positional drainage aids in eliminating the loosened secretions. Relief is often striking, particularly in the chronically ill and in patients with flabby musculature and low diaphragms. The patient should be informed about the effects of this bronchial purge. The syrup of ipecac may be administered in 2 or 3 teaspoonful doses followed by a cup of luke-warm boiled water. This dose may be repeated several days later if indicated.

Endoscopic Therapy

Endoscopic therapy (bronchoscopy, bronchoscopic aspiration, endoscopic instillations of iodized penicillin and streptomycin suspensions and bronchial lavage) plays an important role in the prevention and relief of bronchial obstruction and in the control of infection. It thus prevents the serious sequelae of obstructive emphysema, segmental atelectasis and bronchiectasis.

Bronchoscopy

Bronchoscopy is a very valuable diagnostic and therapeutic procedure and is indicated whenever a harsh, useless cough with dammed-up secretions is present and bronchospasm persists despite adequate physiologic management. Thick, tenacious sputum may be removed, large amounts of the thinner secretions aspirated and bronchial drainage facilitated.

One of the most common and important causes of death in asthma is obstruction of the larger and smaller air passages by inspissation of tenacious secretions. At times spectacular results

may be observed following bronchoscopic aspiration in moribund patients

Waldbott⁵¹ has stressed the value of bronchoscopic aspiration and lavage of the bronchial tree with saline solution in severe attacks. Having witnessed one death and two near fatalities with the use of pontocaine and cocaine sprays and instillations for local anesthesia in asthmatic subjects, I generally prefer deep surgical anesthesia. Vinethene (divinyl ether), employed as a preliminary induction agent to ether, permits a smoother and more rapid induction which is generally free of laryngeal irritation or spasm. The bronchoscopist or anesthetist should flood the airway with oxygen during anesthesia and bronchoscopy. With this technique, intensive bronchoscopic aspiration, including culture and stain of the secretions, followed by bronchial lavage with saline solution, and finally, instillation of a solution of penicillin and/or streptomycin in neosynephrin may prove of life-saving value to the asthmatic subject.

Aspiration of retained bronchial secretions should follow bronchoscopy. Proper bronchoscopic aspiration is usually followed by marked subjective and objective improvement, because it establishes drainage and rids the bronchi of the accumulated secretions. Removal of the bronchial obstruction may prevent or relieve the possible serious sequelae referred to previously.

Endotracheal Instillations

Although the introduction of radiopaque preparations into the tracheo-bronchial tree is essentially a diagnostic procedure, it can be utilized as an effective therapeutic^{52 55} medium. The iodine in the oils is relatively inert and has little or no antiseptic value. However, by mixing with or displacing the pocketed secretions, the instillations mechanically help the patient in cleansing the bronchial tubes, thereby assisting expectoration and subsequent postural drainage. Occasional intrabronchial instillations of suspensions or solutions of penicillin or streptomycin, or both (depending upon the organisms present) in one of the iodine preparations may be of tremendous supplementary value to penicillin aerosol therapy.

In several patients who were producing a great deal of purulent secretions, bronchoscopic aspiration, followed by bronchoscopic instillation of 250,000 units of penicillin and 0.5 grams (500,000 units) of streptomycin in 20.0 cc of Pantopaque was carried out just at the outset of penicillin-aerosol therapy and, on occasion, repeated at weekly intervals if evidence of obstruction and/or infection persisted. We have occasionally mixed penicillin and streptomycin with 1 cc of 1 per cent neosynephrine and 0.20 cc

of Vaponefrin or Isuprel 1 200 in 10 to 20 cc of pantopaque. The mixture was then instilled directly into both lungs through the bronchoscopy. This combination leads to dilution of the sputum and loss of its tenacious mucoid character, thus lessening the necessary effort for expectoration. Patients generally tolerate this procedure very well and feel considerably relieved after evacuating large amounts of secretions and inspissated pus that they previously had been unable to evacuate. The neosynephrin, acting as a vasoconstrictor, and the Vaponefrin or Isuprel acting as a broncho-dilator, provide a more patent airway. The latter also prevents any bronchospasm that might occur following instrumentation and topical anesthesia. The pantopaque solution further helps in cleansing the bronchi and bronchioles of tenacious secretions which have become adherent to the mucosal walls. Furthermore, since the solution is an aqueous one, it does not cling to the bronchial mucosa and hence does not interfere with the action of the penicillin.

Intratracheal Penicillin

Intratracheal penicillin has proven to be of greater value than intramuscular penicillin in the treatment of chronic bronchitis, bronchiectasis and lung abscess.^{52, 55} We have been unable to demonstrate any penicillin in the sputum of patients with suppurative lung disease following intramuscular penicillin.⁵⁵ On the other hand, we have been able to demonstrate high sputum levels in the same patients following aerosol and endoscopic instillations.⁵² In normal subjects, we have also demonstrated adequate penicillin blood levels which persist for a longer period than those following intramuscular injections. These levels were highest when neosynephrin and pantopaque were employed as diluents in place of saline.

The intratracheal technique is simpler than the intrabronchial one, which requires bronchoscopy. However, I prefer the latter in patients with asthma because diagnostic assistance and proper aspiration prior to each instillation can be obtained. Cleaning the bronchi of tenacious secretions by aspiration further insures a concentrated topical effect for the antibiotic. If atelectasis occurs, this procedure should be repeated even more assiduously.

Bronchial Lavage

Penicillin in normal saline solution, sodium sulfathiazole solutions or physiologic saline solutions may be used for bronchial lavage.⁵⁶ Although the principle of irrigation of an affected area may appear surgically sound, nevertheless, the procedure is not without danger, for reinfection, new infection or spread of infection

to involved areas may occur. Finally, the possibility of sensitization to pontocaine (preliminary local anesthetic), with repeated usage should be borne in mind.

Management of Infection in Bronchial Asthma

The role of pathogenic and nonpathogenic bacteria, molds and viruses in bronchial asthma continues to be a debated issue.⁵⁷⁻⁵⁹ Whether or not infection acts as a primary excitant, it is certain that infection is important in producing asthma.

Adequate levels of sulfonamides and antibiotics⁶⁰⁻⁶⁵ in the sputum, the tracheobronchial tree and the pulmonary tissues should be the primary aim in management. In general,⁶⁶⁻⁶⁷ we have found penicillin aerosol disappointing in patients with so-called chronic infectious bronchial asthma, although striking improvement may be occasionally observed. Most of the patients observed, however, that they were able to raise sputum more easily while receiving the penicillin aerosol. The danger of local or generalized allergic reaction must always be kept in mind.

Paranasal sinus disease is responsible for the reinfection and recurrence of cough and wheezing in patients with bronchial asthma. These patients are more likely to have serious asthma, and irreparable sino-bronchitic disease. Treatment should consist of the combined use of antihistaminic preparations and nasal penicillin therapy with the technique of intermittent negative pressure and replacement with penicillin aerosol,⁶⁸⁻⁶⁹ with judicious but minimal surgical assistance. Allergy is the dominant factor in the maintenance of chronic paranasal sinus disease in the asthmatic.

DISCUSSION

In the severe, persistent acute attack or in the continuous state of status asthmaticus, the patient presents a rather serious picture of total physiologic imbalance. Evidence of severe anoxia, cyanosis, dehydration, peripheral vascular shock and drug intoxication from intensive therapy may be present. Death may come suddenly from any of the latter factors, but more commonly is due to the asphyxia resulting from the plugged and obliterated bronchi and bronchioles.

Management of the patient should be based upon the understanding of all the participating forces and their relative values. Correlation of protection studies in the laboratory with clinical experience opens up avenues not possible for complete discussion at this time. The combination of a good antihistaminic and a good anticholinergic drugs with bronchospasmolytic properties should be the ideal therapeutic agent in bronchial asthma. Two drugs, aminophyllin and epinephrine, approach this idea. However, both have certain limitations. We are hopeful of determining a more

effective combination of agents than either of these drugs alone

The physician must acquire a calm serenity and develop endless patience. The patient must have continuous reassurance without sacrifice of a determined positive approach on the part of his physician. This requires the continuous education of the patient and his family. I know of no other disease which can tax the character and scientific skill of the physician as much as the proper management of the very sick asthmatic.

SUMMARY

1) In order to restore physiologic balance in the sick asthmatic, it is necessary to maintain a therapeutic balance. I have attempted to illustrate the various measures which are necessary to balance this therapeutic seesaw.

2) The therapeutic measures suggested are based largely on personal experiences in the management of 513 patients and have been correlated with extensive laboratory studies with a large variety of protecting drugs, employing a method of human assay (protection studies).

3) With this technique, a method of human assay of the relative value of new and accepted therapeutic agents for the relief of bronchial asthma is possible. This technique has afforded us the opportunity of making these studies under controlled conditions usually not present in the sick patient. A comparative study of the protective abilities of several bronchodilators against the effects of intravenous histamine and mecholyl-induced dyspnea and bronchospasm is presented. The role and limitations of epinephrine, aminophyllin and the antihistaminic preparations based on laboratory and clinical correlation is discussed.

4) The role of sedation with drugs and anesthetic agents is presented. The use of chloral hydrate and sodium bromide, demerol, demerol and scopolamine (a modified form of "twilight sleep"), ether and paraldehyde, and caution about the use of sprays or topical pontocaine and cocaine is discussed.

5) Supportive therapy including the replacement of water, glucose, electrolytes and blood plasma is discussed at length. There should be no standard "intravenous cocktail mixture." It should be prescribed according to physiologic needs. Interrupted or continuous intravenoses containing aminophyllin may be of great value. Addition of Cytochrome-C, nicotinic acid, vitamin B Complex or cevitamic acid to the infusion fluid has not proven of striking value. On occasion relaxation followed the use of alcohol-dextrose solution in place of the saline-dextrose infusions. These effects however did not persist with repeated use.

6) The therapeutic use of gases is discussed. Oxygen for the

relief of anoxia and cyanosis, helium and oxygen mixtures for the relief of respiratory obstruction, positive pressure inhalations of oxygen or helium and oxygen for the management of pulmonary edema, carbon dioxide mixtures as expectorants ("bronchial catharsis"), and aerosols of bronchodilator drugs for the relief of bronchospasm or antibiotic drugs for the control of infection

7) Considerable emphasis is placed on the value of bronchial evacuation. Evacuation of the bronchi may be accomplished by "bronchial catharsis," positional drainage, bronchoscopic aspiration and endoscopic lavage. "Bronchial catharsis" in its physiologic sense can be observed with the use of expectorant drugs (e.g., iodides) and syrup of ipecac. Ipecac acts by substituting effective retching for ineffective coughing.

8) The role of infection in bronchial asthma and its management is discussed. Adequate levels of sulfonamides and antibiotics in the sputum, the tracheobronchial tree and the pulmonary tissues should be the primary aim in management. We have been unable to demonstrate any penicillin in the sputum of patients with suppurative lung disease following intramuscular penicillin. On the other hand, we have been able to demonstrate high sputum levels in the same patients following aerosol and endoscopic instillations. In normal subjects, we have also demonstrated adequate penicillin blood levels which persist for a longer period than those following intramuscular injection. These levels were highest when neosynefrin and pantopaque were employed as diluents in place of saline.

9) Paranasal sinus disease is responsible for the reinfection and recurrence of cough and wheezing in patients with bronchial asthma. These patients are more likely to have serious asthma and irreparable sino-bronchitic disease. Treatment should consist of the combined use of antihistaminic preparations and nasal penicillin therapy with the technique of intermittent negative pressure and replacement with penicillin aerosol, with judicious but minimal surgical assistance.

10) The antihistaminics although generally of limited value in the management of the asthmatic subject, may be of considerable value in the following. Orally for the relief of paranasal obstruction (allergy is the dominant factor in the maintenance of chronic paranasal sinus disease in the asthmatic), intravenously to restore the delicate histamine-sympathin balance in the epinephrine refractory state, and for sedative effects in the status state.

RESUMEN

1) A fin de restaurar el balance fisiológico en el asmático enfermo es necesario mantener un balance terapéutico. He tratado

de ilustrar las varias medidas que son necesarias para balancear este vaivén terapéutico

2) Las medidas terapéuticas que se sugieren están basadas en gran parte en la experiencia personal obtenida en el tratamiento de 513 casos y han sido correlacionados con extensos estudios de laboratorio con una gran variedad de drogas protectoras, empleando el método de ensayo humano (estudios de protección)

3) Con esta técnica es posible desarrollar un método de ensayo humano del valor relativo de agentes terapéuticos, tanto nuevos como aceptados, para el alivio del asma bronquial. Esta técnica nos ha dado la oportunidad de hacer estos estudios bajo condiciones comprobadas, que generalmente no existen en el caso del enfermo. Se presenta un estudio comprobado de la habilidad protectora de varios broncodilatadores contra los efectos de la disnea y el broncoespasmo causados por la inyección intravenosa de histamina y mecolil. A base de correlaciones clínicas y de laboratorio, se discute el papel y las limitaciones de la espinefrina, la aminofilina y las preparaciones antihistamínicas.

4) Se presenta el papel de la sedación con drogas y agentes anestésicos. Se discute el empleo del hidrato de cloral y el bromuro de sodio, del demerol, del demerol y la escopolamina (una forma modificada del "medio sueño"), del éter y el paraldehído y se cauciona acerca del uso de rocíos o la aplicación tópica de la pontocaína y la cocaína.

5) Se discute a lo largo la terapia sustituyente, inclusiva de la restitución de agua, glucosa, electrolitos y plasma sanguínea. No debe existir un "cocktail intravenoso" típico. Debe recetarse de acuerdo con la necesidad fisiológica. Las infusiones intravenosas, interrumpidas o continuas, que contengan aminofilina pueden ser de gran valor. La adición al líquido de la infusión de Citocromo-C, ácido nicotínico, complejo vitamínico B o ácido cevitámico no ha demostrado ser de gran valor. Ocasionalmente se obtuvo dilatación mediante el empleo de una solución de alcohol y dextrosa en vez de las infusiones de salina y dextrosa. Sin embargo, con el uso repetido, no persistieron estos efectos.

6) Se discute el empleo terapéutico de gases: oxígeno para el alivio de anoxia y cianosis, mezclas de helio y oxígeno para el alivio de obstrucción respiratoria, inhalaciones de oxígeno o de helio y oxígeno bajo presión positiva para el tratamiento del edema pulmonar, mezclas de bióxido de carbono como expectorantes ("purga bronquial"), y aerosoles de drogas broncodilatadoras para el alivio de broncoespasmo o drogas antibióticas para combatir la infección.

7) Se ha hecho considerable hincapié sobre el valor de la eva-

cuación bronquial. Se puede obtener la evacuación de los bronquios mediante la "purga bronquial," la canalización por postura, la aspiración broncoscópica y el lavado endoscópico. En su sentido fisiológico se puede obtener la "purga bronquial" mediante el empleo de drogas expectorantes (por ejemplo, los yoduros) y el sirope de ipecacuana. La ipecacuana actúa por la substitución de los esfuerzos vómicos eficaces por la tos ineficaz.

8) Se discute el papel que desempeña la infección en el asma bronquial y su tratamiento. El objeto primordial del tratamiento debe ser el obtener niveles adecuados de sulfonamidas y antibióticos en el esputo, el árbol tráqueobronquial y los tejidos pulmonares. No hemos podido demostrar ninguna penicilina en el esputo de pacientes con enfermedades supuradas de los pulmones después de la administración intramuscular de la droga. Por el contrario, sí hemos podido demostrar elevados niveles en el esputo de los mismos pacientes después de la inhalación de aerosoles o instilaciones endoscópicas. En sujetos normales también hemos demostrado adecuados niveles sanguíneos de penicilina que persisten por un período más largo que los que siguen a la inyección intramuscular. Estos niveles fueron máximos cuando se empleó neosinefrina o pantopaco como diluentes en vez de salina.

9) La infección de los senos paranasales es responsable por la reinfección y reaparición de tos y respiración difícil en pacientes con asma bronquial. En estos pacientes es más común el asma grave y la enfermedad seno-bronquítica irreparable. El tratamiento debe consistir del uso combinado de preparaciones antihistamínicas y de la terapia nasal con penicilina, usando la técnica de presión negativa intermitente y reemplazo con aerosol de penicilina, y de una sensata y mínima asistencia quirúrgica.

10) Las drogas antihistamínicas, aunque generalmente de valor limitado en el tratamiento del sujeto asmático, pueden tener considerable valor en los casos siguientes: por la vía oral para el alivio de obstrucción paranasal (la alergia es el factor dominante en el mantenimiento de infección crónica de los senos paranasales en el asmático), por la vía intravenosa para restaurar el delicado balance histamino-simpático en el estado refractorio a la epinefrina, y por los efectos calmantes en el status asmaticus.

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D I S C U S S I O N

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In discussing this instructive paper on treatment of asthma, I wish to confine myself to one point which I believe is most important to chest physicians, namely, bronchoscopic lavage. One of my patients with chronic asthma had become progressively worse in spite of the application of most known therapeutic measures. While he was in an extremely critical stage, I called in one of our leading bronchoscopists to have him aspirate the mucous plugs of which there had been evidence and, which he had ceased to expectorate. The surgeon refused to do a bronchoscopy because of the risk involved. A second surgeon was persuaded to undertake it, but upon re-examining the patient he too decided against it because of the hopelessness of the situation.

and the possible risk involved. A third consultant refused when he was given the details of the case. A fourth chest surgeon finally inserted a bronchoscope and removed about 120 cc of thick, gluey material, whereupon the patient promptly recovered, his pulse became palpable, the cyanosis disappeared, he became conscious, and on the following day he could leave the hospital. This story is typical. It demonstrates the dramatic result from bronchoscopic lavage and the reluctance of chest surgeons to perform it.

The rationale for this treatment is based on the following: Through the antigen-antibody reaction, histamine is formed which produces bronchospasm and an increase in mucous secretion. If the asthma persists the mucus thickens—as it does in the sinuses and in the nose in hay fever,—it becomes infected, glue-like and so adherent to the wall that the relaxation of the bronchi produced by aminophyllin no longer suffices to release it. This mucus acts as a check valve through which air enters but becomes trapped on expiration, similar to the presence of a foreign body.

In practice, there are five indications for bronchoscopic lavage. First, as a life saving procedure in a moribund patient. I have observed nine cases of dramatic recovery from an extreme condition similar to the one quoted. In every one a large amount of mucus was removed. In one of these patients with periodic attacks of great severity which occurred during her menstrual periods, bronchoscopic lavage promptly relieved the attacks. On several occasions it had been life saving. Once the bronchoscopist was not available immediately upon admission of the patient to the hospital and she expired. The second indication is to break up a chronic state of asthma, regardless of its severity. In 152 bronchoscopies, 50, or one-third, were followed by improvement, in eight, a single bronchoscopy produced complete relief. The third indication is to remove a mucous plug causing atelectasis of a small pulmonary area or a whole lobe. A fourth reason for bronchoscopic lavage is the dilatation of a bronchial stricture. In this series there were three patients exhibiting this condition. The effect of dilatation cleared up persistent asthma of long standing. The fifth condition requiring bronchoscopic lavage is the removal of mucus resulting from bronchiectasis.

Bronchoscopic lavage should not be carried out if there is no evidence of mucus, namely, a) in asthma of short duration, b) in allergic bronchitis, where petechial hemorrhages and urticaria-like edema are present in the bronchial mucosa, c) in sudden allergic shock due to ingestion or inhalation of antigens to which extreme sensitivity exists.

There are hazards in bronchoscopy which justify to some extent

the reluctance of bronchoscopists to perform it There is sensitivity to, and intolerance of, local anesthetics Sensitivity is characterized by an unusual degree of edema at the area where the anesthetic is applied and by dyspnea It may give rise to most serious complications and death It can be controlled by large doses of epinephrin, by intravenous aminophyllin and intravenous antihistaminics Intolerance to anesthetics is suggested by muscular twitching, nervousness, sensation of heat, and, finally convulsions Here, intravenous pontocain may be applied as an antidote In addition, there may be sensitivity and intolerance to pre-operative drugs, particularly to opiates Even Demerol and Pantopon which I formerly considered harmless have given rise to serious accidents Patients may be sensitive to many other medications which had been, and still are being, applied intra-bronchially, such as argyrol, diluted phenol solution, pontocain sulfathiazole solution, penicillin and streptomycin Severe dyspnea sometimes is noted after bronchoscopy if the mucus has been loosened but not thoroughly removed In this emergency, one should be prepared to reintroduce the bronchoscope

As to the technique, local and general anesthetics should be avoided if at all possible Aminophyllin should be given intravenously before and, if necessary, during bronchoscopy Small doses of epinephrin (1/10 cc) given subcutaneously may aid in the relaxation of the bronchi Penicillin may be introduced into the bronchi only after it has been ascertained that the patient is not sensitive to it

Bronchoscopy in extremely severe asthma is as obligatory a procedure as the removal of a foreign body from the bronchi or a tracheotomy in diphtheria

D I S C U S S I O N

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I think you all have been as much stimulated as I have by the comprehensive and brilliant discussion of Dr Segal I have nothing to say in disagreement with anything he has presented

I would like to confirm most of what Dr Waldbott has said Bronchoscopic aspiration is, to my mind, one of the most important methods of converting the patient with status asthma or intractable asthma into a patient with a remission I never use local anesthetic in these patients I believe in employing ether anesthesia in all it is entirely safe in my experience and can

often be done in the patient's room I have seen many patients of the type described by Dr Waldbott, who looked as if they were going to die, and following bronchoscopic aspiration recovery took place It is also true that in a certain number of patients, one or two or sometimes three rectal instillations of 125 cc of ether with olive oil will be followed by a remission

Demeral to my mind is a most helpful drug in aiding to eliminate the intractable asthmatic state We have used it in something over 500 patients and I have never seen any ill effects from its use, unless combined with overdosage of barbiturates It is a bronchodilator Dr Segal has shown you some of the studies on protection The most important thing to bear in mind in these cases is that there must be a period of time, four or five days or a week, in which cessation of all bronchodilator medication of the type of epinephrin, ephedrine and aminophyllin is carried out These patients often get into a vicious cycle of taking more and more of these drugs, and unless they are stopped for a period the vicious state will continue One of the advantages of bronchoscopic aspiration is that one may then stop the bronchodilator drugs During the period in which this medication is stopped it is often helpful to use various forms of inhalation therapy One cannot allow the patient to gasp for breath, but a combination of demeral and oxygen may tide him over for four or five days during which time no other drugs are used Following that one frequently sees a restoration of sensitiveness to these bronchodilator drugs Aminophyllin, although a brilliant and important remedy, may perpetuate recurring sieges of asthma if not stopped when the time comes when it is giving diminishing returns I feel there are very few contraindications to bronchoscopy under ether I do agree that there is no point in doing it if a patient has a dry cough, but for aspiration of retained mucus it is indicated I have seen secretions removed that must have been present for a long time on the bronchial mucous membrane

Closing Remarks

Maurice S Segal, M.D., F.C.C.P. I am very grateful to both Dr Barach and Dr Waldbott for stating so clearly their views on the value of bronchoscopy Fortunately, I happen to work in Boston, where bronchoscopists are capable and numerous, and are usually willing to perform the procedure One patient recently, for all practical purposes, was dead prior to bronchoscopy I am sure we have saved life on more than one occasion

I want to emphasize the type of atelectasis we usually see in our very sick patients with bronchial asthma We do not see the type of massive atelectasis that Dr Waldbott showed you We do see

segmental atelectasis, and in several instances at least, we have felt it had gone on to bronchiectasis because of lack of proper management I want to stress again the role of "catharsis" in treatment of bronchial asthma both in its psychic and in its somatic sense

In conclusion, there are still many more fancies than facts, and even differences of opinion about the facts, in treatment of bronchial asthma

The Clinical Significance of Pulmonary Hemorrhage: A Study of 1316 Patients with Chest Disease*

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The purpose of this communication has been to try to evaluate the clinical significance of hemoptysis, to show its frequency of occurrence in pathological lesions of the thoracic cavity, and to evaluate the diagnostic measures which we now have at hand relative to the symptom of pulmonary hemorrhage. Since the advent of safe thoracic surgery the challenge towards more accurate diagnosis of the cause of pulmonary bleeding has been thrust upon us. Many of our previous concepts of the clinical significance of thoracic symptomatology should now be brought up for statistical evaluation, and some will then need actual revision. The possibility of a prevalent misconception in regard to pulmonary bleeding has instigated this study. In the decade prior to 1940 this symptom was considered presumptive evidence of pulmonary tuberculosis, and even today many nontuberculous patients are being sent to tuberculosis sanatoria because of this symptom alone. Too frequently the bronchiectatic describes a fruitless stay in a sanatorium. In 1936 Wientzen and Sjorslev¹ noted that only 582 of 869 patients admitted to a sanatorium because of hemoptysis actually had pulmonary tuberculosis. Andosca and Foley² in 1942 stated that carcinoma of the lung was the most common cause of pulmonary bleeding in people past the age of 45 years. They stressed the influence of age, in the group from 20 to 40 years, they noted tuberculosis to be the leading cause, followed by bronchiectasis and mitral stenosis, while the influence after the age of 40 years becomes first, carcinoma, second, tuberculosis, and third, bronchiectasis. In 1942 Jackson and Diamond³ described 436 patients with hemorrhage of non-tuberculous origin. Tabulation of the causes of such bleeding showed (See table on next page)

They noted that 140 of the patients presented a normal appearing plain chest x-ray film. The site of bleeding was visualized at bronchoscopy in 109 of the 436 patients. The 34 cases showing no

*From the Department of Surgery, Emory University Medical School. Presented at the 13th Annual Meeting, American College of Chest Physicians, Atlantic City, New Jersey, June 8, 1947.

Bronchiectasis	138 cases
Carcinoma	82 cases
Tracheobronchitis	74 cases
Pulmonary abscess	51 cases
No evidence of disease	34 cases
Bronchial adenoma	11 cases
Miscellaneous causes	46 cases

evidence of disease and the foregoing statements emphasizes our diagnostic limitations. Despite the emphasis placed by these authors upon the protean causes of pulmonary hemorrhage, one constantly encounters faulty conceptions of the clinical significance of this symptom in the overall picture of thoracic disease. Much of our study lends emphasis to the statements of the three aforementioned communications, but that alone would be justification for this presentation.

The data on 1,316 patients, who have been brought to the attention of a thoracic surgeon, has been reviewed. Figure 1 is a list, in detail, with the order of frequency of appearance of the various lesions which were encountered in this series. This group is not

FIGURE 1

DISEASES ENCOUNTERED IN 1316 CASES PRESENTED

Tuberculosis	302	Bronchial Asthma	5
Bronchiectasis	239	Bronchial Ulcer	5
Bronchogenic Carcinoma	187	Atelectasis	5
Mediastinal Tumors	70	Osteomyelitis of Rib	4
Lung Abscess	65	Mediastinitis	4
Traumatic Chest Wounds	64	Bronchial Stricture	3
Empyema	53	Spontaneous Thrombosis	
Cardiac Disease	40	Superior Vena Cava	3
Metastatic Carcinoma	25	Pericarditis	3
Pulmonary Infarction	25	Pulmonary Emphysema	3
Chronic Bronchitis	23	Pneumatocele	3
Esophageal Obstruction	22	Silicosis	3
Hemoptysis	19	Functional Dyspnea	2
<i>(Undetermined Etiology)</i>		Bronchogenic Cysts	2
Congenital Cysts	19	Agenesis of Lung	2
Non-Specific Pneumonitis	16	Bronchial Endometriosis	2
Aneurysms	14	Broncholith	2
Diaphragmatic Hernia	13	Lipoid Pneumonitis	2
Fungus Disease	9	Floating Rib Syndrome	2
Sinusitis	8	Eventration of Diaphragm	1
Cardiospasm	8	Hamartoma	1
Tumor of Chest Wall	8	Hematoma of Lung	1
Bronchial Adenoma	7	Endobronchial Polyp	1
Diverticulum of Esophagus	5	Shrapnel in the Heart	1
Diseases other than Thoracic	5	Myasthema Gravis	1
Foreign Body	5	Sarcoma of Pleura	1

necessarily comparable to that seen by the internist, who sees a much larger percentage of patients with pulmonary bleeding associated with mitral stenosis, pulmonary and systemic hypertension We have purposely omitted cases of hemoptysis occurring only in association with the "prune juice" sputum of lobar pneumonia Emphasis in this study is laid upon the patient having hemoptysis as a symptom of chronic intrathoracic disease It is justified at this point to stress the potential significance of unusual or prolonged hemoptysis in patients diagnosed as having "acute pneumonia" Although other symptoms usually have been present, not infrequently does surrounding pulmonary infection cause the first visit of the patient with bronchogenic carcinoma to his physician Just as delay in the resolution of the x-ray shadow following pneumonia may arouse suspicion of carcinoma, prolonged or recurrent hemoptysis in "acute pneumonia" has been found worthy of investigation and may reveal associated neoplasm

The event of the coughing up of blood is not necessarily related to the physician unless specific inquiry is made This is especially true of patients with bronchiectasis who have had slight streak-

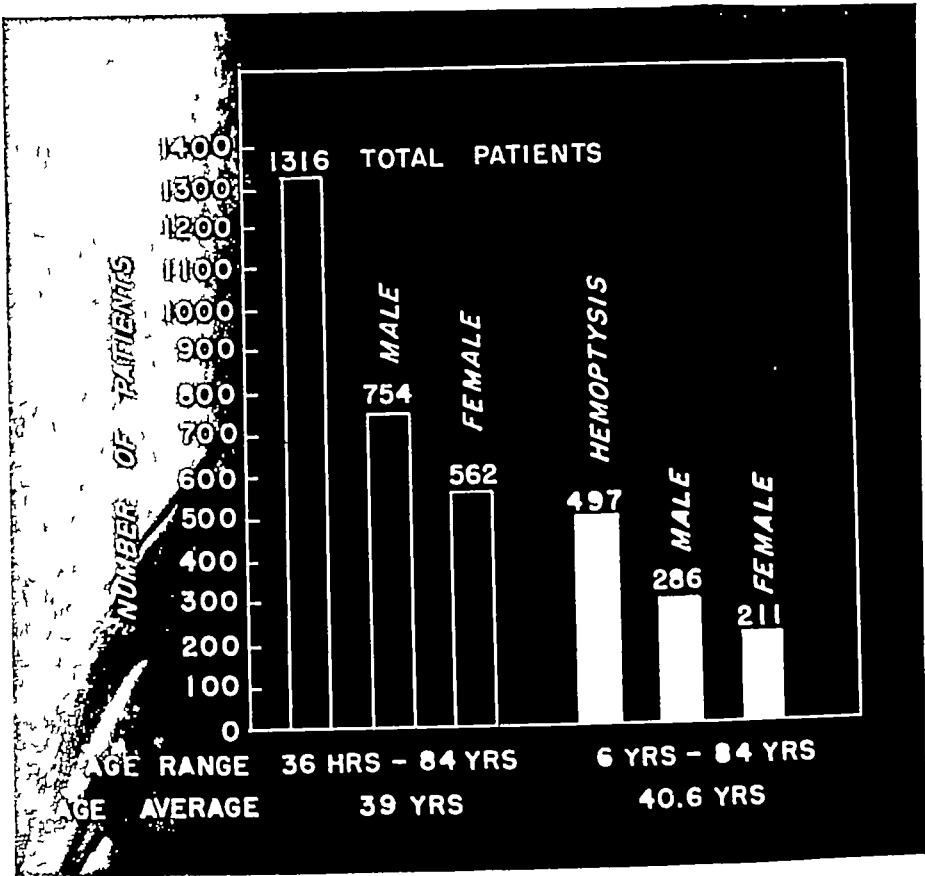


FIGURE 2

ing or even more active bleeding for so many years that it is no longer a matter of alarm. Also it is necessary to remember that some patients, especially children, may swallow the sputum and thus not note the presence of blood.

We are all familiar with the confusion caused by diseases of the upper respiratory tract which may cause bleeding of sufficient extent for the blood to enter the bronchial tree. Assiduous attention to this area as a possible site of bleeding in patients complaining of the coughing up of blood must be maintained. However, much unnecessary delay in the diagnosis and treatment of pulmonary disease has occurred when hemoptysis has been carelessly explained away as being due to bleeding from the upper respiratory tract without adequate investigation and proof.

The Statistical Study of the Significance of Hemoptysis

This series of 1,316 cases has been made up of patients covering a group from 7 years to 87 years of age (Fig. 2). The average

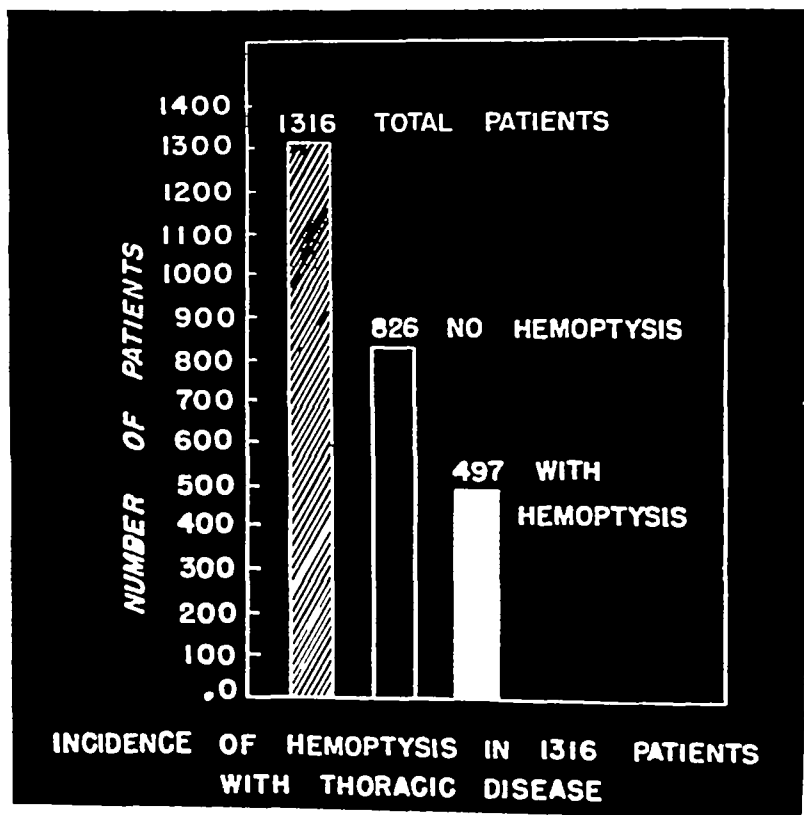


FIGURE 3

age of the entire group is 39 years. The sex incidence constitutes 55 per cent male and 45 per cent female. Of the 1,316 cases, 497 gave a history of bleeding from the lung, or 38 per cent of the entire group (Fig 3). This group of cases describing hemoptysis, subdivided as to sex, is shown to be 56 per cent male and 44 per cent female, and is essentially equivalent to the sex incidence of the entire series.

Of the bleeding which occurred, the term "streaking" is self-explanatory. This was seen in 33 per cent of the cases relating pulmonary bleeding (Fig 4). Sixty-seven per cent of those having hemoptysis brought up sputum which they described as being pure blood in varying amounts. No important correlation can be made between the type of hemoptysis and the underlying disease entity. An attempt was made to correlate the incidence of bleeding with the involvement of individual pulmonary lobes. Inasmuch as many of the cases had bilateral disease, there was a certain

FIGURE 4

	Patients
Frank Hemoptysis	318
Scant or Streaking	174
Degree Undetermined	5
TOTAL	497

FIGURE 5

LOCATION OF BLEEDING SITE

	Patients		Patients
Rt Upper Lobe	63	Lt Upper Lobe	82
Rt Middle Lobe	30	(<i>Lingula 20</i>)	
Rt Lower Lobe	75	Lt Lower Lobe	92
"Right Lung"	49	"Left Lung"	38
TOTAL	217	TOTAL	212

FIGURE 6

LOCATION OF DISEASE

	Patients
Right Lung	217
Left Lung	212
Bilateral	74
Carina	2
Mediastinum	14
TOTAL	519

proportion in which the actual localization of the bleeding could not be determined, so that the total location of lesions, of necessity, represents a greater number than the total number of patients presenting a history of hemoptysis. Localization of the lesions is outlined in Figures 5 and 6. This tabulation shows no greater preponderance of hemoptysis-producing lesions in either lung or in individual lobes. However, it has been our experience in patients having normal appearing plain x-ray films of the chest to find the site of origin most commonly in the right middle lobe or in the lingula of the left upper lobe. These lesions have been in the main localized bronchiectasis or small abscesses. No explanation for the predilection of these areas as sites of such disease is suggested.

It was also of interest to note the relationship of hemorrhage to the time of onset of symptoms in chest disease. The gradual and insidious onset of symptoms has made it difficult to individualize the first symptom in many patients. We have been impressed with the early onset of fatigue and weakness as an initial symptom of chronic pulmonary suppuration and tumor, but because of

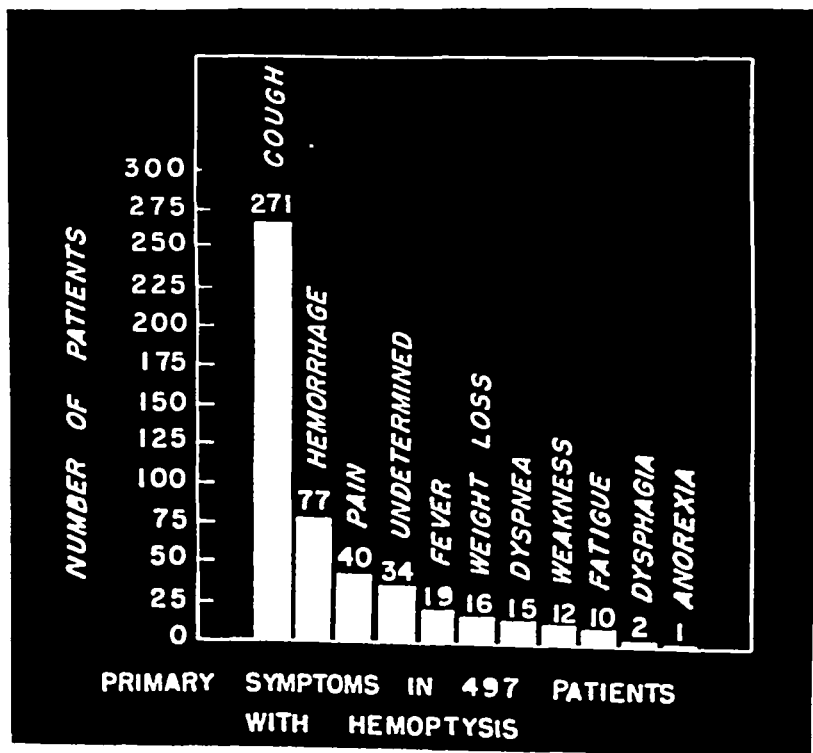


FIGURE 7

the gradual, increasing character of this complaint, the patient's tendency to explain fatigue on the basis of other causes, and the early lack of appreciation of the importance of this symptom by the physician, the true place of this complaint in the symptom-atological sequence is not shown in this analysis. With these considerations in mind, Figure 7 is presented mainly to show the much greater preponderance of cough as a primary symptom,

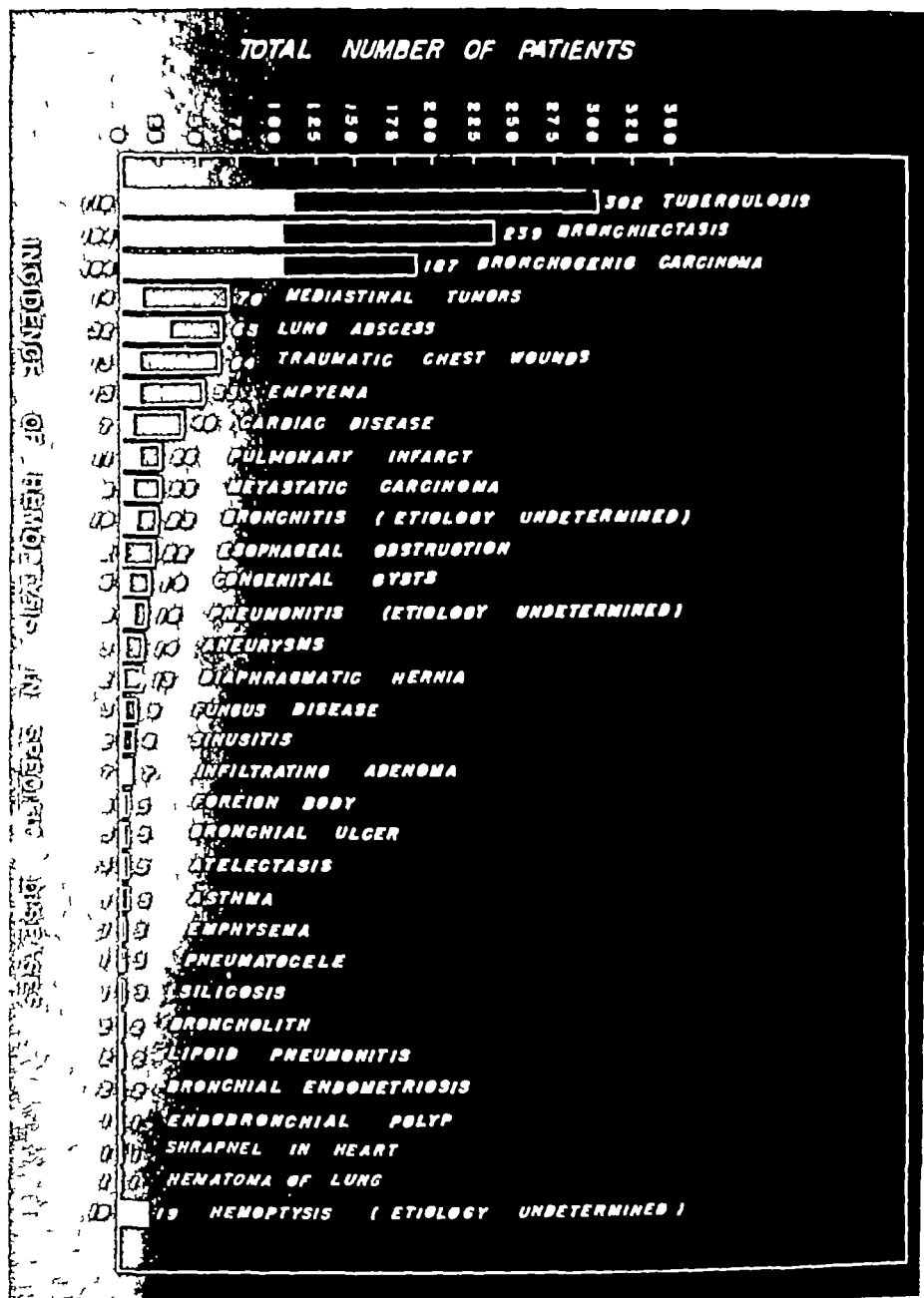


FIGURE 8

occurring in 62 per cent of the cases, while hemoptysis, as a first symptom, was only noted in 21 per cent of the patients Jackson and Diamond³ referred to the relative rarity of hemoptysis as an initial symptom in bronchogenic carcinoma, and we find statistical corroboration of their impression that bleeding is more commonly a late occurrence in the sequence of symptoms in bronchogenic carcinoma

The diseases were analyzed in regard to the relative incidence of hemoptysis in each, and this is shown in Figure 8. Thus, we see an almost equal amount of shaded area in the column signifying bronchogenic carcinoma, bronchiectasis, and tuberculosis, although tuberculosis was the disease most commonly encountered. In order to bring out this incidence in a more emphatic manner, Figure 9 represents percentage incidence of bleeding in individual diseases, and shows that bronchogenic carcinoma leads all the rest with 53.6 per cent, while lung abscess has 49 per cent, pulmonary infarct 44.0 per cent, bronchiectasis 43.5 per cent, bronchitis (chronic unobstructed) 43.5 per cent, tuberculosis 36.5 per cent, congenital cyst 25.8 per cent, emphysema 24.5 per cent, metastatic carcinoma 24.0 per cent, mediastinal tumors 20.0 per cent, cardiac disease 17.5 per cent, and esophageal obstruction 9 per cent.

In view of the common concept of the incidence of hemoptysis in tuberculosis, it would seem best to describe the tuberculosis

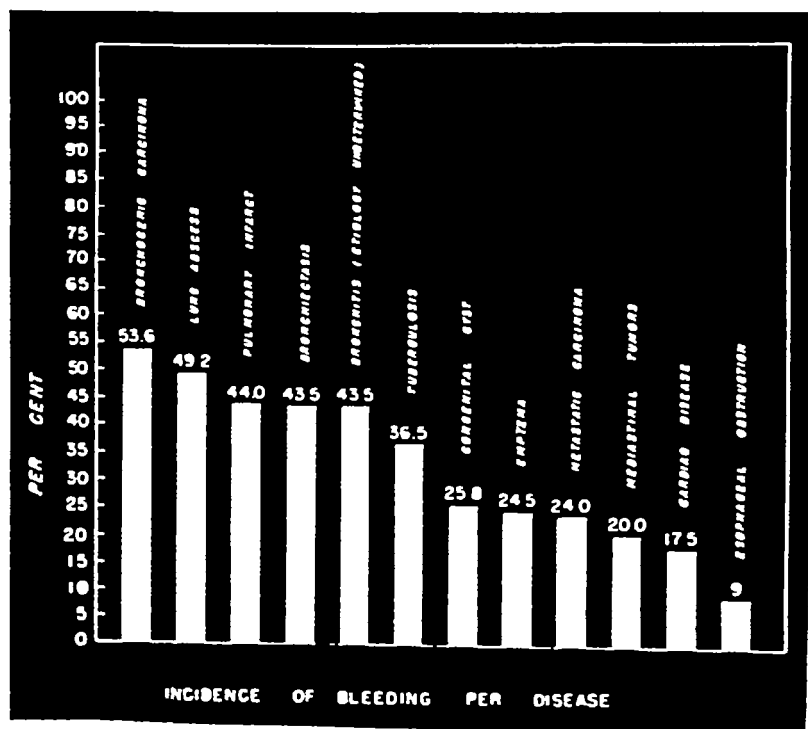


FIGURE 9

series first. The cases of tuberculosis constitute 302 patients, in which group 36.5 per cent noted bleeding. It should be emphasized that this was a group of patients in a sanatorium with disease of long standing. Each was individually questioned regarding hemoptysis, so that even single instances of streaking were included in the bleeding group. It is felt that this group of tuberculous patients constitutes a good general average type similar to those who might be seen by the diagnostician.

It is fitting, in view of the present concept of the significance of hemoptysis, that the next group should be the group with bronchogenic neoplasms. There are 187 patients in this group of which 53.6 per cent complained of hemoptysis in varying degrees. In reviewing any large group of patients with bronchogenic carcinoma, it is striking to note the difference of the time of onset of bleeding in relation to the duration of the disease. There is a distinct tendency for this symptom to occur relatively late in the sequence of symptoms, being preceded by change in cough pattern, and by fatigue and by bizarre sensations in the thorax. It also must be stressed that lesions occurring within a major bronchus, must be expected to present the symptom of hemoptysis at an earlier stage than lesions occurring in the periphery of the lung parenchyma. Indeed, in many instances, lesions must be expected to produce hemoptysis in direct relation to the tendency for that area of the lung to become infected. It is striking not only statistically, but also in our clinical observations, that one notes the high incidence of hemoptysis in cases of pulmonary abscess, and also for the tendency of this bleeding to be more excessive in this type of lesion. Thus, in our group of 65 cases of lung abscess, 49.2 per cent described hemoptysis as a prominent symptom. In any case of chronic pulmonary suppuration, it is reasonable to expect bronchial ulceration and secondary bleeding. It is not surprising to see that 43.5 per cent of a group of 239 patients with bronchiectasis had hemoptysis. It would be well to mention, however, the frequency with which this bleeding is not in large amounts and, also, the frequency with which such bleeding occurs only in bronchiectasis of long standing—five or ten years. The hemoptysis seen in so-called "dry bronchiectasis" deserves mention as it may be the only symptom of the disease.

The occurrence of hemoptysis in association with empyema of the chronic type appears to be quite high in the attached chart. Many of these patients described the bleeding occurring with their initial pneumonia, or with recurrence of same, and it has been attempted to describe the symptom only as that occurring in relation to their empyema, rather than in relation to the primary pneumonia. A distinct number of these patients developed

a postpneumonic bronchiectasis, as well as empyema, and bled, in all probability, from this source. Other patients undoubtedly bled from too rigid drainage tubes which may have been in malposition. Still another group includes hemoptysis occurring in empyemata with bronchopleural fistula.

The group of patients, described as chronic nonspecific bronchitis, was 23 in number and showed 10 patients, or 43.5 per cent, with bleeding. This, of course, does not constitute the actual occurrence of hemoptysis in this disease. The majority of these patients were referred to the chest clinic because they were thought to have lesions other than chronic bronchitis, or because of the hemoptysis itself, and we were unable to define any other lesions as the actual cause. It would perhaps be best to classify each of the patients having bleeding in chronic bronchitis, as patients with bronchial ulcer, but such ulcer was outside the range of vision of the bronchoscope.

Again, the figures for bleeding in relation to heart disease must be qualified, because, in the majority of the cases, the patients were referred to the chest clinic because of the cardiac lesion rather than because of the hemoptysis itself. The statistics for the occurrence of bleeding in relation to foreign body show 43 per cent of such patients presenting hemoptysis. These were all instances of foreign body which may not have been suspected prior to referral to the chest clinic, or instances of foreign body of long duration. This lesion, in the acute stage, is more frequently seen by the otolaryngologist.

It is of importance to note the frequency of hemoptysis in metastatic carcinoma, that is, 5 patients in a group of 24, or 21 per cent. It is felt that little attention has previously been drawn to this occurrence. We have encountered four instances of major endobronchial metastasis in the past few months, secondary in one instance to sarcoma of the bone, in another instance to transitional-cell carcinoma of the testicle and in 2 cases to carcinoma of the breast.

The occurrence of hemoptysis in relation to aortic aneurysms is not uncommon, just as we see hematemesis in association with certain aneurysms eroding into the gastrointestinal tract. In the thorax the bleeding may not necessarily be due to actual communication between the aorta and the bronchial tree, but can be secondary to compression effect upon the bronchial tree. It happens that two patients presenting hemoptysis in connection with aortic aneurysm were encountered in the recent work which we have been carrying out in the form of cellophane wrapping of such lesions and, in both instances, there was a direct com-

munication between the aorta and bronchus, which was remedied on the operating table at the time of aneurysmorrhaphy

It is not felt that any specific discussion need be attached to the occurrence of hemoptysis in relation to congenital cyst inasmuch as the bleeding occurred in all instances of cysts with secondary infection. It is similarly felt that infection played a role in the occurrence of hemoptysis secondary to atelectasis of undetermined origin. The series of idiopathic bronchial stenosis is too small to warrant any specific deductions, but the high incidence of hemoptysis is certainly striking. The occurrence of broncholith, as a cause of hemoptysis, has long been recognized and indeed, is frequently the reason for which the patient with broncholith consults.

The extremely high incidence of hemoptysis in relation to crushing injury of the chest, following injury by penetrating missiles, both gunshot wounds and penetrating instruments, is as one would suspect. Some stress should be laid upon the frequency with which pulmonary infarction may not be associated with hemoptysis, namely 56 per cent. The importance of lipoid granuloma or lipoid pneumonitis, as a cause for bleeding, deserves some stress inasmuch as one of the patients had four almost fatal hemorrhages and underwent total pneumonectomy under supposition of carcinoma, but the specimen revealed a diffuse lipoid granulomatosis of the entire lung associated with bronchiectatic change. The second patient, having the same disease, had less bleeding, but this proved to be his only symptom and led to x-ray investigation.

The group of patients with either chest complaints or hemoptysis, and with a final classification of "etiology undetermined," reminds us of our present limitations. However, it is felt that further periodic follow-up investigation is mandatory in this group. They may represent bronchial ulceration distal to the range of vision of the bronchoscope, small infarctions, pulmonary hypertension, blood dyscrasias in the stage of associated normal laboratory findings, and so forth. Although there may be such an entity as true "idiopathic pulmonary bleeding," it would be a healthier attitude to call it "pulmonary bleeding, etiology undetermined." In further consideration of patients with pulmonary disease associated with hemoptysis, we must mention that it is encountered in such diseases as pulmonary emphysema which, in all probability, is associated with chronic pulmonary suppuration and fibrosis. It also occurs with pneumatoceles, which are seen as a manifestation of the results of emphysema in this type of case. Its occurrence is also noted in the patients with bronchial asthma, being found most frequently with the intrinsic type of

bronchial asthma which is the type most commonly seen by the thoracic surgeon

It should be emphasized that hemoptysis does not necessarily denote primary disease of the lung. Such disease may be secondary from overflow spillage in an obstructed esophagus, it consists of secondary bronchiectasis and chronic pulmonary suppuration. The important thing which we would like to stress in this regard is the occurrence of hemoptysis in association with tumors of the mediastinal structures. Thus, we have found the mediastinum as the primary site of disease in 14 patients presenting the symptom of pulmonary bleeding. Hemoptysis can occur in association with pulmonary hypertension which is so frequently a corollary of mitral stenosis and, thus, we have observed 7 patients, in a group of 40 cardiacs, presenting the symptom of pulmonary hemorrhage. It should be further stressed that pulmonary bleeding is an unusual occurrence in cardiac disease of congenital origin, although it may be masked because of its occurrence in children. Pulmonary hemorrhage, however, is not unknown in children, as exemplified by hemoptysis in our youngest patient who was 7 years of age. We also note pulmonary bleeding in association with disturbances of mediastinal vessels, such as aneurysm of the aorta and of the pulmonary artery. Apology must be made for the relative scarcity of the mycotic lesions of the bronchial tree as there are only 9 patients with such disease listed in this large group and, of the 9 cases, 3 presented bleeding. Again, it must be emphasized that in all probability some of the group with "chronic bronchitis" were fungus disease without a positive culture or smear being obtained.

The Investigation of Patients with Pulmonary Hemorrhage

One would like to lay considerable stress upon the importance of noting the character of a patient's hemoptysis associated with so-called acute lesions of the lung. It has been a distressing experience to all people particularly interested in the subject of pulmonary neoplasm and of tuberculosis, to find that frequently the first cause of a patient's consulting a physician has been a so-called "classical pneumonia." When we question these patients we find that they have had atypical hemoptysis in association with this pneumonia which should have led the attending physician to suspect some other disease. Any patient having what is suspected to be acute lobar pneumonia or bronchopneumonia in whom the hemoptysis lasts for more than a 48 hour period, should be considered atypical. This is especially true if there was not the classical 'prune juice' type of sputum and if the patient has a recurring production of small amounts of little blood clots,

or streaking, over a period of several days. Furthermore, if this patient should show any so-called slow resolution of pneumonic process, it is mandatory to rule out obstructive lesions of the bronchial tree.

In questioning any patient in regard to hemoptysis, one must be particularly conscious of the possibility of the patient's own localization of the hemorrhage (Fig 10). Unfortunately, this does not occur in all cases. Frequently, a patient who could not previously localize his hemorrhage, after being told to make sure on a subsequent occasion, will be able to point practically to the direct spot overlying the area of pulmonary ulceration. The symptoms which patients may associate in their chests with hemoptysis, consist largely of sensation of deep burning pain or discomfort, either prior to or subsequent to the hemorrhage. In hemoptysis of any degree, the patient may describe a bubbling sensation or an internal scratching sensation at the area of hemorrhage. Physician patients, in whom it has been our privilege to observe pulmonary hemorrhage, frequently describe the definite sensation of inability to breathe with the involved lung during the time of bleeding, and a splinting of the chest which they are unable to control. We have found the position which the patient assumes during hemorrhage to have some localizing value. Frequently they prefer to lie upon the side from which the bleeding arises, both because of lessening of cough due to contralateral spillage and a subconscious desire towards splinting the affected side.

As physicians, we are all duly impressed with the importance of careful examination of the chest in the patient who is actively bleeding, which must be done with a minimum of disturbance to the patient, omitting percussion and only the gentle application of the stethoscope as necessary. It is extremely important in such cases, if we hear an area of distinct pulmonary infiltration or coarse rhonchi localized to one side, that we must consider this

FIGURE 10

SUBJECTIVE LOCALIZATION OF PULMONARY BLEEDING

A Antecedent, associated or subsequent chest sensations

- 1 Burning
- 2 Heaviness
- 3 Bubbling
- 4 Vague pain
- 5 Bronchial roughness or scratching

B Sensation of splinting

- a Decreased aeration capacity on side involved
-

a possible adjunct to our localization of the site of bleeding. This is, of course, open to considerable question because of the possibility of spill-over, especially into the right main bronchus, and we will note considerable erroneous findings due to spill-over if we are not conscious of this potentiality.

The need of an x-ray as an aid to showing areas of possible sites of pulmonary bleeding, the use of bronchography and of the bronchoscope, and sputum studies, do not need further mention. However, it is of importance to remember that in some cases, wherein it is particularly difficult to define the site of bleeding, it may be necessary to bronchoscope the patient during the actual bleeding period in order to see the site of bleeding and outline the proper course of therapy.

One cannot discuss the investigative measures relative to pulmonary hemorrhage without mentioning the group of patients in whom no demonstrable cause was found. Thus in our group there are 19 cases or 0.5 per cent of the group with bleeding. In the series of Jackson and Diamond,³ mention is made of 34 cases or 0.8 per cent of the total. They noted the site of bleeding in 73 of a total of 82 cases of bronchogenic carcinoma. Since the earlier examination of patients with this lesion, the frequency of positive bronchoscopic biopsy has decreased from previous claims of 70 to 80 per cent to below 50 per cent. This has also been due to the increased use of exploratory thoracotomy in peripheral lesions. Recent papers have shown the value of study of the sputum for tumor cells and which may give 85 to 90 per cent positive diagnosis in pulmonary neoplasm. This then is an helpful adjunct to the diagnostic armamentarium and should decrease the limitations of our present modes of investigation. As the years have progressed, greater interest has been paid to mycotic lesions. True pathogenicity of previously unsuspected fungi has been recognized. The greater the interest of the diagnostician in mycotic lesions, there is an increasingly greater number of pulmonary mycoses discovered.

Exploratory thoracotomy is now an accepted and clinically safe operative procedure. With the intelligent use of this procedure a still further reduction of the category of "hemoptysis, etiology undetermined" can be expected. Undoubtedly, there are instances in which determination of the etiology of pulmonary bleeding may not be of practical therapeutic benefit to the patient. Thus both our group of "chronic bronchitis" and Jackson and Diamond's group of "tracheobronchitis" may not have benefitted clinically from intensive investigation, but together they constitute only 10 per cent of our combined groups, while 29 per cent of the combined group proved to have bronchogenic carcinoma. There-

fore, it is felt that since hemoptysis signified serious underlying disease in 85 to 90 per cent of cases, intensive investigation is necessary and further improvement of our diagnostic methods should be sought

SUMMARY AND CONCLUSIONS

1) A study of 1,316 patients with thoracic disease has been presented, 497 of whom had suffered pulmonary hemorrhage

2) The clinical significance of pulmonary bleeding has been statistically evaluated

3) This symptom predicates serious underlying disease in 90 per cent of patients presenting it and demands immediate and intensive investigation

4) The relative frequency of the occurrence of hemoptysis in individual disease entities has been noted. It may occur in any disease associated with bronchial ulceration or compression. The relatively higher incidence in bronchogenic carcinoma, bronchiectasis and lung abscess than in pulmonary tuberculosis has been stressed. The occurrence of bleeding with mediastinal lesions and tumors metastatic to the lung is emphasized.

5) Emphasis is laid upon the importance of any variation from the usual type of hemoptysis seen in "acute pneumonia," and the need for investigation to rule out possible underlying neoplasm.

6) No correlation can be made between the type of hemoptysis and the underlying disease, other than a tendency to more copious hemorrhage in patients with pulmonary abscess.

7) The importance of the patient's subjective localization of the bleeding site is stressed, and the methods of clinical investigation outlined and discussed.

8) With the addition of staining methods for the study of tumor cells in the sputum and the intelligent use of exploratory thoracotomy, a decrease in the "hemoptysis, etiology undetermined" group is to be expected.

9) It is hoped that this analysis may aid in a better understanding of the clinical significance of pulmonary hemorrhage and thus lead to the earlier recognition and treatment of thoracic disease, especially tumors.

RESUMEN Y CONCLUSIONES

1) Se ha presentado un estudio de 1,316 pacientes con enfermedad torácica, 497 de los cuales sufrieron hemorragia pulmonar.

2) Se ha hecho un avalúo estadístico del significado clínico de la hemorragia pulmonar.

3) Este síntoma indica la existencia de enfermedad grave en el 90 por ciento de los pacientes que lo presentan, y exige inmediata e intensa investigación.

4) Se ha anotado la relativa frecuencia de hemoptisis en diferentes entidades morbosas. Puede ocurrir en cualquiera enfermedad acompañada de ulceración o compresión bronquiales. Se ha recalcado que este síntoma es relativamente más frecuente en el carcinoma broncogénico, la bronquiectasia y el absceso pulmonar que en la tuberculosis pulmonar. Se ha hecho hincapié sobre la ocurrencia de hemorragia en lesiones mediastínicas y en metástasis pulmonares de tumores.

5) Se recalca la importancia que se le debe dar a cualquiera variación del tipo común de hemoptisis que ocurre en "neumonía aguda," y la necesidad de hacer una investigación para eliminar la posible existencia de un neoplasma.

6) No se puede hacer ninguna correlación entre el tipo de hemoptisis y la enfermedad que la causa, excepto que en pacientes con absceso pulmonar existe la tendencia a hemorragias más copiosas.

7) Se recalca la importancia de la localización subjetiva del paciente del sitio de la hemorragia, y se bosquejan y discuten los métodos clínicos de investigación.

8) Con la adición de técnicas colorantes para el estudio de células de tumores en el esputo y el inteligente empleo de la toracotomía exploratoria, se espera que disminuirá el grupo "hemoptisis, etiología no determinada."

9) Se abriga la esperanza de que este análisis pueda ayudar a un mejor entendimiento del significado clínico de la hemorragia pulmonar y que conduzca así al reconocimiento y tratamiento precoces de enfermedades torácicas, especialmente tumores.

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D I S C U S S I O N

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In connection with the control of pulmonary hemorrhage I wish to report two cases in which total pneumonectomy as an emergency measure had to be performed to control pulmonary hemorrhage. The operations were by Dr. A. Rodríguez Díaz, chief of our surgical staff.

One was a 22 year old male with extensive tuberculous lesions

that affected almost the entire left lung This patient was contemplating a total pneumonectomy when he presented an acute reactivation fever of 104, intensely toxic He was treated with streptomycin, aerosol and intramuscular Temperature became normal within 15 days Four days later he had a profuse hemorrhage that could not be controlled with the usual procedures Pneumothorax could not be used because it was previously attempted in various occasions and failed The internists thought that his only chance was resection in spite of the fact that the right lung showed a slight bronchogenic spread

Total pneumonectomy was performed under penthotal, endotracheal nasal intubation and local anesthesia The streptomycin was continued The patient received a total amount of 200 grams He is perfectly well 4 months after operation

The second case was a 52 year old male with multiple abscesses of the right lung, who had an uncontrollable hemorrhage of three day's duration Total pneumonectomy was resorted to as a desperate measure and the patient is well three months after operation

D I S C U S S I O N

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Dr Abbott has given us a clear understanding of the significance of pulmonary hemorrhage by enumerating the many conditions which may be associated with the expectoration of blood This symptom constitutes a direct challenge to the clinician for it usually is associated with advanced disease irrespective of the cause and hence, demands an early complete, detailed diagnostic study if the patient is to receive curative therapy In my experience the symptom which most frequently brings the patient to seek medical advice is the presence of blood in the sputum Were hemoptysis an earlier symptom, particularly in tuberculosis and malignancy, these patients would consult a physician much sooner and our salvage rate would show a significant rise But unfortunately, it is not In only 18 per cent of Jackson's cases of malignant bronchial tumors was it an initial manifestation and of the 82 cases who had hemoptysis definite changes in the x-ray film were clearly present In tuberculosis, we found that 35 per cent of the patients admitted to the sanatorium gave a history of hemoptysis and nearly all belonged to the moderately and far advanced group

I would like to emphasize the diagnostic importance of a careful history and physical examination. Many of us are too prone to rely too much on x-ray examination with minor regard being placed on the physical findings. In those cases where roentgen study has been negative, one should not too readily assume without further proof that the cause of the bleeding is a bronchial erosion. One must be ever aware of the possible existence of a more serious pathological condition, and I would make a plea for earlier bronchoscopic study and even if this be negative and the symptoms persist, to repeat the examination early.

A case I saw will emphasize the points I have made, namely, the importance of the proper evaluation of physical signs, the frightening effect of hemoptysis and the value of early bronchoscopy. About four years ago, I was consulted by a physician, forty-five years of age. For four weeks, especially in the evenings, he had been bothered by a wheeze which he had never noted before. This was associated with a minimal dry cough which he had had for many years. This apparently caused him no concern until the morning that I saw him, when he noted streaks of blood in his sputum after a mild coughing spell. Chest examination revealed a few fine inspiratory and expiratory squeaks over the left lower lobe. A chest x-ray film was negative and inspiratory and expiratory films failed to show any evidence of obstructive emphysema. In spite of this, in view of the other evidence which we had, namely, recent onset of wheezing in a forty-five year old male with localized signs in the chest and bloody sputum, it was felt that he probably had a tumor in the left lower lobe bronchus. Bronchoscopy was advised and this revealed the presence of a mass in the left lower lobe bronchus which on biopsy proved to be malignant. A left pneumonectomy was done by Dr. Brian Blades, and the patient is now back in practice.

D I S C U S S I O N

LESLIE B. SMITH, M.D., F.C.C.P.
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It is time for all of us to put forth an effort in the dissemination of the material presented by Dr. Abbott, to the profession as a whole. To illustrate the point I would like to cite one simple case.

A midwestern banker, whose age was 60, coughed up some blood 18 months before I first saw him. He went to his physician, who examined him and who was thorough enough to even take an

x-ray picture of the patient's chest The physician informed the patient that there was "a small spot on the lung and for him to take it easy" During the next 18 months this patient continued to have blood-streaked sputum on several occasions, for which he consulted the physician several times At least on three occasions during the 18 months period he had a definite pulmonary hemorrhage After about 16 months of observation the physician told the patient, "Bill you had better go to Arizona for a few months before you get into trouble" Needless to say, when this patient arrived in Arizona we saw a pathetic picture, that is an extensive, inoperable carcinoma of the lung Had this patient's physician been duly impressed by the significance of hemoptysis, or had the patient himself, it is my opinion that he was seen early enough that his life might have been spared by surgical procedures

Dr Abbott has told us that tuberculosis is too frequently considered the cause of hemoptysis and has shown us that actually it ranks below carcinoma During the course of years an axiom has arisen in the medical profession which is to the effect "that hemoptysis is tuberculosis until proved otherwise" Then too frequently we find doctors shortening this statement to read "hemoptysis is tuberculosis," and without too thorough a search the diagnosis is missed, when an individual has a curable disease This axiom should be destroyed and maybe a new one substituted to the effect that "hemoptysis is carcinoma of the lung until proved otherwise" It is my opinion that we, as members of the American College of Chest Physicians, should put forth a desperate effort to publicize this point to the medical profession, as well as to the laity

In the same vein of thought there is another almost axiomatic statement which we often hear, namely that "a spot on the lung is tuberculosis", hence, many physicians and a great proportion of the laity consider the term "spot on the lung" and tuberculosis to be synonymous If we are to continue to destroy carcinoma of the lung before it has reached an incurable state we must put forth a campaign to destroy this fallacious impression

In closing I wish to urge that we diligently crusade to publicize to the medical profession as well as to the laity, the type of knowledge given us this morning by Dr Abbott He has dealt with symptoms, which are things that doctors and laity alike should be able to interpret more accurately, if they are given the proper basic information

Streptomycin in Tuberculous Meningitis

Report of a Case*

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The treatment of tuberculous meningitis with streptomycin is under critical observation at the present time. The advent of this new drug was greeted with much enthusiasm but further clinical experience on a greater number and variety of cases has led to better appreciation of its merits and dangers. It is true that in most cases of tuberculous meningitis the immediate effects of streptomycin therapy have been so striking as to promise hope of recovery. On the other hand many of these hopes have not materialized.

The following is a report of a case of proven tuberculous meningitis that has been treated with streptomycin.

The patient, F McK. a 34 year old, white male, entered the hospital on the 21st of June, 1946, with the diagnosis of meningitis of unknown origin. His chief complaints were headache, blurred vision, malaise, nausea and vomiting. These had been ushered in a few hours previously by a single shaking chill followed by a temperature rise to 101 degrees F.

He gave a history of known tuberculosis of the right lung which was discovered in July 1945 and was responding satisfactorily to pneumothorax therapy. In December of 1945 a small amount of fluid was aspirated from the right side of his chest. At that time he also developed ascites and 2000 cc of straw-colored peritoneal fluid were removed. He gave a history of drinking unpasteurized milk. He did not use alcohol and never had catarrhal jaundice. Sputum has been negative for acid-fast bacilli since April of 1946. The last pneumothorax refill was administered five weeks prior to his present illness. There were no other pertinent findings in his past medical history and his family history was not significant.

Physical examination revealed a toxic, irritable white male, complaining of severe headache and nausea. Speech was thick and difficult. Response to verbal stimulation was slow and labored. He could not write or read his own name. He exhibited nuchal rigidity, absent deep tendon reflexes and positive Babinski, Chaddock, Gordon and Oppenheim signs. Tuberculous meningitis was considered the most likely diagnosis but considerable laboratory work was done to rule out other conditions.

The agglutination series was negative, malaria studies were negative, the icteric index was 5 and the cephalin flocculation showed nothing abnormal. On admission the blood count showed 844 per cent hemo-

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globin, 4,250,000 RBC, 6,000 WBC, with a normal differential count. Urinalysis and serologic studies were negative. The spinal fluid showed no organisms at first but the second tap revealed pellicle formation and a few acid-fast bacilli were seen. These were later cultured. The spinal fluid was cloudy, globulin was greatly increased, the cell count was 139 with 80 per cent polymorphonuclear cells and 20 per cent lymphocytes, dextrose was 37 mgm per cent and the tryptophane test was positive. The sputum was repeatedly negative for acid-fast bacilli.

The temperature on admission was 102 degrees F, the pulse was 100 and the respiratory rate 20 to 25. Penicillin therapy was immediately started but had no effect. Blurring of vision became more marked and difficulty with urination developed. The temperature continued to rise daily to 102 degrees F and projectile vomiting made its appearance. The patient's condition, heretofore, critical, now became grave.

On the 28th of June, eight days after admission, streptomycin therapy was instituted and on the 30th of June the penicillin was discontinued. Initially the patient was given 2½ grams daily in divided doses by the intramuscular route and 100,000 units intrathecally every other day. His general condition immediately started to improve. During the first month the temperature gradually subsided. The number of cells in the spinal fluid diminished considerably and the fluid itself appeared clearer although a pellicle still formed on standing. Headache, nausea and vomiting persisted but were not so bothersome. The patient was frequently flushed after intrathecal injection of the drug and complained of shooting pain down the legs. This was also accompanied by a transient increase in severity of the headache and dizziness.

Gradually the nuchal rigidity decreased but did not disappear completely until 4 months later. All other neurological signs disappeared with the exception of ankle clonus which persisted for five months.

The second month of treatment was marked by further clinical improvement which was very slow and steady. Some of the signs of streptomycin toxicity made their appearance. These were slight deafness, tinnitus, pain in the legs on intrathecal administration, nausea and varying degrees of hyperaesthesia. This called for a change of dosage and thereafter the patient received 100,000 units of streptomycin every four hours intramuscularly, while continuing on the same intrathecal dose. The above-mentioned signs then lessened.

In the third month of treatment the drug was discontinued for five days because the patient had improved so greatly and the test period was over. Vomiting began three days after discontinuance accompanied by a rise in temperature. Streptomycin therapy was quickly resumed in the same dosage but the vomiting persisted and became very severe. The white blood cell count remained normal and the number of cells in the spinal fluid rose only slightly. The sugar content of the fluid remained at 27 mg per cent and the chlorides at 528 mg, the cobweb coagulum still being present. No organisms could be recovered or cultured. Intractable vomiting now became a great problem. Intravenous fluids and blood transfusions were frequently given. Amino acids or plasma by vein invariably produced severe reactions. The patient became dehydrated and lost flesh rapidly. The blood chlorides sank to 247. This, in combination with a blood pressure of 90 over 72, weakness and vomiting prompted the empirical use of adrenal cortical extract and salt. Unfortunately the laboratory was not equipped to do blood sodium or potassium determin-

ations Atropine sulphate did not relieve the vomiting and it was only after a Miller-Abbott tube was passed through the pylorus and hourly jejunal feedings given that the patient was brought under control After one week the blood pressure and chlorides rose to normal levels so the administration of adrenal cortical extract was stopped The tube remained in situ for ten days Then the patient began to eat well enough to warrant its removal Slowly he began to regain the ground he had lost He no longer complained of headache but did become quite dizzy upon raising the head Vomiting attacks gradually decreased in frequency and severity until occasional morning nausea was all that was noted

By the end of the fifth month the patient had shown much clinical improvement Vomiting was very infrequent and only occurred after breakfast Fluids and most solid foods were very well tolerated He looked forward to recovery with amazing confidence characterized by a cheerful and alert mental attitude Speech was normal and writing improved rapidly Further progress was evidenced by a daily walk about the room despite dizziness He used a bedside commode Because of occasional diplopia and somewhat hazy vision several eye consultations were requested All these examinations were negative During the course of the month his weight was not quite maintained and his muscles remained flabby Whenever streptomycin was administered intrathecally the same shooting pain was noticed in the underlying leg and in the scrotum

The laboratory now reported a slightly xanthochromic spinal fluid with only eighteen cells, increased globulin and a normal dextrose content of 50 mg per cent A pellicle still formed on standing but yielded no acid-fast bacilli on culture or guinea pig inoculation The blood count continued to show a moderate anemia and the sedimentation rate was 16 mm per hour The NPN and blood sugar were normal and the total plasma proteins were 7.4 with 3.63 globulin The only persistent neurological finding was a mild degree of ankle clonus The temperature varied from 98.0 to 99.6 degrees F

Streptomycin was continued in the same dosage throughout the sixth month and clinically the patient improved in spite of the spinal fluid findings He felt well even though dizziness persisted whenever he stood upright Toward the end of the month he was walking to the bathroom His gait was so unsteady that he had to support himself by touching or holding nearby objects Ankle clonus decreased A good appetite was responsible for a two-pound gain in weight Diplopia and hazy vision remained about the same All tests of kidney function were satisfactory The red cell count and hemoglobin rose slightly but the white cell count was somewhat low at 4,500 No eosinophiles were present The sedimentation rate varied from 9 to 15 mm, the spinal fluid sugar rose to 90 mg per cent, the cells reached 200 and the protein increased to 108 The patient's temperature during this month frequently reached 99 and occasionally 100 degrees F Sputum remained negative for acid-fast bacilli

A milestone in the history of the case was reached in the seventh month for it was then that streptomycin therapy was finally discontinued The patient began to complain of increasing pain in the hips upon intramuscular injection and so it was decided on January 10, 1947 that this mode of administration be stopped Intrathecal injections

were continued as before but it quickly became apparent that this also was causing increasing distress. The pain would now begin as soon as the needle was introduced whereas previously it had never occurred until the drug was injected. In addition it was becoming more difficult to perform an adequate puncture due, presumably, to the local changes that had taken place in the tissues. On the 15th and 18th of the month the patient developed transient paraplegia and a transient loss of bladder function. For this reason intrathecal injections of streptomycin were discontinued. Since that time he has received none of the drug whatsoever.

A neurological examination now revealed atonia of all muscles, particularly of the lower extremities. The muscles were flaccid and weak. All deep tendon reflexes were active and no sensory disturbances were present. Ankle clonus was no longer apparent. A caloric stimulation test was normal for both ears but a whispered voice test showed loss of the ability to hear high tones. The patient had no difficulty in hearing the normal speaking voice.

It is interesting to note that prior to the discontinuance of streptomycin, particularly in the last month of treatment, the temperature frequently reached 100 and occasionally 100.6 degrees F, but as soon as the drug was stopped the temperature fell and since that time has only once been above 99.2.

The patient was cheerful and boasted of a good appetite. Clinically he gained with amazing rapidity. The most remarkable occurrence was a 14-pound gain in weight during the seventh month of treatment. Diplopia and hazy vision gradually decreased. His gait was still very unsteady.

The last spinal fluid examination prior to termination of the drug therapy showed 24 cells, 49 mg per cent sugar and a negative tryptophane test. Cultures continued negative for acid-fast bacilli. Other laboratory data which included complete blood counts, urinalyses, brom-sulfalein, urea clearance, NPN, creatinine and sugar were all within normal limits.

In the middle of February, one month after discontinuance of the streptomycin, a change was seen in the patient's condition. Headaches became more severe and the customary cheerfulness changed to apprehension. Suspicions were aroused when he gained six pounds in one week in spite of the fact that he was not eating with the usual relish. He complained of weakness and scanty urine. Physical examination revealed a moderate amount of fluid in the abdomen. This was not tapped. A complete physical and laboratory work-up showed that the fluid was not due to constrictive pericarditis or interference with portal circulation. Tuberculosis was considered the most likely cause but actual proof was lacking. Within two weeks spontaneous diuresis occurred with resulting loss of ascites and a 10-pound loss of weight. This episode is interesting in view of the fact that the patient was reported to have had ascites in December of 1945. For the remainder of the month he felt well except for an increase in the frequency of his headaches. These would now occur about three times a day, at 2 a.m., 11 a.m., and 3 p.m., which coincided with sleep or rest hours. He obtained relief only by getting out of bed and walking about.

During the second month after termination of drug therapy clinical improvement continued. There was no evidence of fluid in the abdomen.

He gained weight at a more normal rate, about a pound or two a week. The frontal headaches that appeared during the reclining hours persisted in varying degrees of intensity and they were still relieved by standing up and walking. Dizziness was practically absent and deafness was not noticed in ordinary conversation. His gait had improved so remarkably that he could walk about without support. The diplopia and hazy vision had decreased to such an extent that he could read a newspaper or write a letter with apparent ease.

The patient showed gradual improvement during the next few months. Slowly but steadily his activities were increased without untoward effect. Walking to the washroom helped him regain the muscular tone of his lower extremities. A certain degree of ataxia was present but became increasingly difficult to demonstrate. The headaches decreased in number and intensity until they disappeared. On the fourth of July, 1947, he suffered an acute attack of appendicitis and at the time of operation the appendix had ruptured due to the patient's refusal to accept early surgery. Microscopic examination of the appendix and culture of drainage were negative for acid-fast infection. Examination of the peritoneal cavity at the time of operation failed to reveal any evidence of tuberculosis. This is important in view of the patient's past record of recurrent episodes of ascites.

Recovery from this operation was rapid with gradual cessation of drainage and thorough healing of the wound. Convalescence was uneventful. By the end of the month the patient was out of bed again and shortly reached his previous level of ambulatory efficiency.

He remained in the hospital three months following his appendectomy, during which time no further improvement was noted. He appeared perfectly normal except for slight ataxia and a moderate degree of high tone deafness. Tests of vestibular function by the Kobrak method of caloric stimulation were within the normal limits. His ordinary gait was without flaw but he had difficulty walking with his eyes closed. Neurological tests failed to reveal any other dysfunction. In September of 1947 after stating that he "never felt better in my life," he left the hospital against medical advice. His departure occurred fifteen months after admission and eight months after discontinuance of streptomycin therapy.

Due to the fact that he returned to the hospital about twice a month for pneumothorax refills, we were able to follow his case quite adequately. He has been observed for six months in this manner and he is still in a state of remission. He appears normal in all respects but when specifically questioned, it is learned that slight ataxia persists as evidenced by inability to walk along a narrow plank and a feeling of insecurity while driving a car fast. Adequate financial compensation has so far spared him the necessity of working. In January 1948 he married and is at present leading a happy home life.

SUMMARY

A case of a man with proven tuberculous meningitis is presented. After initial streptomycin therapy was instituted, he showed marked clinical improvement. When the drug was discontinued he suffered a severe relapse. Renewal of streptomycin therapy was barely able to stave off a fatal termination but after four additional months of treatment he slowly progressed to a point

where it was deemed feasible to discontinue the drug. He received about 160 grams of streptomycin in seven and one-half months by the intramuscular and intrathecal routes. His course after treatment was marred by one relatively short, self-limited episode of ascites and an attack of acute appendicitis for which an appendectomy was performed. Symptomatic therapy played a large part in combating his disease. Certain findings which persisted for several months after therapy but which eventually disappeared completely, were headache and haziness of vision. Other findings which improved after therapy but which still persist are slight ataxia and high tone deafness. The patient seems to be adequately compensating for his vestibular dysfunction. All during his illness and up to the present time he has been receiving pneumothorax refills. The chest lesion shows no change and the sputum is still negative. Twenty-two months have passed since the onset of his disease, the last six of which he has spent at home with no ill effects.

Considering the percentage of fatality in tuberculous meningitis, even since the advent of streptomycin, it is felt that this patient has progressed remarkably, possibly further than any that have been treated with this drug, and it is hoped that as time goes on the possibility of a relapse will become even more remote. October 15, 1948, still well clinically.

RESUMEN

Se presenta el caso de un hombre con meningitis tuberculosa comprobada. Después de haberse iniciado la estreptomicinoterapia el paciente mostró decidida mejoría clínica. Cuando se discontinuó la droga, sufrió una recaída grave. La reanudación de la estreptomicinoterapia a penas evitó un desenlace fatal, pero después de cuatro meses adicionales de tratamiento progresó poco a poco hasta tal punto que se creyó posible discontinuar la droga. El paciente recibió, aproximadamente, 160 gramos de estreptomicina por las vías intramuscular y cefalorraquídea en siete meses y medio. Su curso después del tratamiento fue complicado por un episodio relativamente corto de ascitis, que terminó solo, y por un ataque de apendicitis aguda que necesitó que se le hiciera una apendectomía. La terapia sintomática desempeñó un gran papel en combatir la enfermedad. Dolores de cabeza y vista enfoscada fueron hallazgos que persistieron por varios meses después de la terapia, pero que al fin y al cabo desaparecieron por completo. Otros hallazgos que mejoraron con la terapia, pero que todavía persisten, son ataxia leve y sordera para los tonos altos. El paciente parece estar igualando adecuadamente su disfunción vestibular. Durante toda su enfermedad y hasta la fecha ha estado recibiendo insu-

flaciones de neumotórax La lesión torácica no ha variado y el esputo continua negativo Han pasado veintidós meses desde el comienzo de su enfermedad, los últimos seis de los cuales los ha pasado en su casa sin mal efecto alguno

Tomando en consideración el porcentaje de desenlaces fatales en la meningitis tuberculosa, aun desde el advenimiento de la estreptomicina, se opina que este paciente ha progresado extraordinariamente, posiblemente más que ninguno otro que ha sido tratado con esta droga, y se abriga la esperanza de que mientras más tiempo pase menor será la posibilidad de que sufra una recaída

Combination Promin and Streptomycin Therapy for Tuberculosis

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Antibiotics have been assuming a greater place in our armamentarium for the treatment of tuberculosis. Various drugs have been tried from time to time. Some of them have been discarded completely, others have been used for specific types of cases.

As time has gone on, it has become evident that dosages were entirely erratic and, further, that a combination of some of these drugs might be more efficacious.

An unusual experience (discussed in Case No. 1) resulted in the use of promin in the treatment of renal tuberculosis. The result was so dramatic that unhesitatingly this drug was used in the treatment of two more cases. In the meantime, streptomycin had become available. During the months that streptomycin was used, the necessity of smaller doses was realized, at least in the average case. Since excellent results had previously been obtained with promin in the treatment of renal tuberculosis and with the thought that a combination of promin and streptomycin might be more effective, or at least allow a decrease in the dosage of streptomycin, a combination of these two drugs has been administered in a few cases.

The streptomycin was given for a two-week period and then the patients were given a week of rest without treatment. The streptomycin was given in $\frac{1}{4}$ gram dosage twice daily. This regime was continued until they had received a total of approximately sixty grams of streptomycin. During the time that streptomycin was administered, two grams of promin was also given intravenously by one injection daily. This was given for a six-day period, and omitted the seventh day. It was given again for six days followed by an eight-day rest. This regimen was continued during the time that the patient was on streptomycin therapy.

All types of tuberculosis are being treated by this program, and it is my impression that the results are fully as good as when larger doses of streptomycin alone were used. However, this series of patients is small and the period of observation is short.

The last two cases of renal tuberculosis were treated by a combination of streptomycin and promin as given above. The results have been fully as dramatic as when promin was used. It was of

interest that this treatment had no effect on a tuberculous orchitis and tuberculous epididymitis except that when these lesions were excised, the wound healed promptly. Summaries of the renal tuberculosis cases are presented in order to stimulate further interest in the use of this combination by others.

Case No 1 J J, age 52, a white male. This patient was first seen in October, 1945. History revealed that kidney trouble had been present since 1918 which came to a climax first in February, 1944, when he was first cystoscoped and was told that he had tuberculosis of both kidneys. He was again cystoscoped at a later date and the diagnosis of bilateral renal tuberculosis was confirmed. When seen in October, he was having marked frequency, burning and smarting on urination, together with pain in the kidney regions. The urine was loaded with tubercle bacilli.

Streptomycin was not available to a private practitioner at this time and it was impossible to get the patient to a Veterans Administration Hospital for immediate treatment. Therefore, promin was finally resorted to as an alternative means of treatment. The patient was given two grams of promin in solution intravenously each day for twenty-four days with the exception of the second day when he was given four grams. The increased dosage on the second day caused considerable headache and, as a consequence, the dose was resumed at two grams per day. At the end of this period of treatment, the patient's symptoms had completely disappeared.

However, in July, he had an injury to the kidney regions after which reactivation of his symptoms occurred. He was given two more injections of promin and again his symptoms disappeared completely.

The patient was not seen again until February of 1947 at which time he reported that he had been to the Veterans Administration for another cystoscopic examination the previous week when no evidence of active renal tuberculosis was demonstrated. In February he was apparently healthy, gaining weight, and had no urinary symptoms.

Case No 2 F.J.K., age 32, white male. This patient developed pain in the lower back in September, 1947, when he also had pus in the urine. In October, he developed pain in the right leg suggestive of sciatica. In November he went to an osteopath and from that time on lost weight rather rapidly. His urinary symptoms consisted of an increase in day frequency and he voided three or four times each night. He also had burning and smarting on urination.

In November he had an x-ray inspection in our Miniature Film Survey when far advanced, bilateral pulmonary tuberculosis was diagnosed and he was advised to enter the sanatorium. However, before he could be admitted, the right testicle became swollen and was painful on pressure. This involvement eventually included both the testicle and the epididymis.

The patient was admitted to the sanatorium on December 19, 1947, at which time the urine was positive for tubercle bacilli. He was immediately started on streptomycin and promin therapy. One week later arrangements were finally made for a cystoscopic examination. Retrograde pyelograms at this time revealed evidence of tuberculosis of the right kidney and ureter. However, specimens of urine obtained at this time were negative for tubercle bacilli on guinea pig inoculation. All

other specimens obtained since have been negative for tubercle bacilli. Streptomycin and promin had no evident effect on the tuberculosis of the testicle and epididymis. On February 7, 1948, the right testicle and epididymis were removed surgically. The one point of interest was that the operative wound healed immediately and has remained so.

After approximately ten days of streptomycin and promin therapy, the patient's symptoms disappeared. He is still being continued on the treatment.

Case No 3 U.P.D., age 27, white female. This patient's first symptoms date to 1942 following the birth of a normal baby. She then developed bladder pain, high fever, burning and smarting on urination with pain in the left kidney region. Cystoscopic examination revealed evidence of tuberculosis of the left kidney which was then removed.

She had had some pain of the lower abdomen with frequency and some burning and smarting since this operation. This became worse in the summer of 1946, and the symptoms never improved. Sulfa drug did not improve the condition. Later tubercle bacilli were found in the urine.

After consultation with an urologist, it was decided that this patient should not be cystoscoped, at least until after a trial of streptomycin and promin therapy, because she had already had one kidney removed. Therefore she was admitted to the sanatorium and immediately started on streptomycin and promin. Within three weeks her symptoms had disappeared. The urine became negative for tubercle bacilli at the end of five days and has remained negative. She is being continued on this regimen of treatment.

SUMMARY

1) Case reports are presented to stimulate interest in the use of streptomycin and promin as a combination in the treatment of tuberculosis and especially in renal tuberculosis.

2) The series of cases presented is small and the period of treatment short, therefore the results are merely suggestive of a new trend of thought which we think worthy of further consideration by other clinicians.

RESUMEN

1) Se presentan informes de casos para estimular el interés en el empleo de la estreptomicina y la promina combinadas en el tratamiento de la tuberculosis, y especialmente de la tuberculosis renal.

2) La serie de casos presentados es pequeña y el período de tratamiento corto, por consiguiente, los resultados meramente sugieren una nueva idea que creemos merece la consideración adicional de otros clínicos.

Solving the Problems of the Tuberculous War Veteran*

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A great deal has been written about the problems of the tuberculous war veteran. The impression has been created that he is an individual set apart from the rest of the communal family and is somewhat of a problem child. Public attention having been focused on this thought, it has been assumed that all the problems in connection with the hospitalization of the tuberculous veteran, are indigenous to this particular group of people.

It has been generally accepted that the most serious problem of the tuberculous war veteran is the difficulty in keeping him continuously hospitalized until his disease has become arrested or until he has attained the maximum benefit from hospitalization and will no longer be a menace to the community.

However, a careful study of the subject indicates that a similar problem exists in most tuberculosis hospitals in this country. Tuberculosis Topics¹ reports that approximately 30 per cent of the patients in all the tuberculosis hospitals in the United States left institutions against medical advice during the war years. Drolet² made a survey of tuberculous patients discharged from 41 institutions in the New York metropolitan area, which includes adjacent New Jersey. He found that out of 10,620 patients discharged during the year of 1945, approximately 29 per cent left against medical advice. In one of these hospitals, out of a total of 257 discharges, 89 per cent left against medical advice and in another hospital 55 per cent left against medical advice out of a total of 1,045 discharges.

It is generally recognized that an arrest of the disease can be attained in the majority of cases of minimal and moderately advanced and in a considerable percentage of far advanced cases of pulmonary tuberculosis, if the patient remains continuously hospitalized long enough under appropriate treatment.

The study of the causes for irregular discharges from tuber-

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culosis hospitals and of measures to be taken for their prevention must therefore be high on the agenda of every organization interested in the control of tuberculosis

Undoubtedly the reasons vary to a certain extent among different groups of patients and in different types of hospitals. It is, however, a known fact that the standard of medical care is very rarely the cause. A review of the table prepared by Drolet shows a high rate of discharges against medical advice among hospitals having the most modern buildings and equipment and known to be very well staffed and well managed. A patient is, as a rule, not in a position to know which treatment is standard and which is substandard. Hence, the great success enjoyed by patent medicines, fads and quacks.

During the war a considerable number of tuberculous veterans left the veterans hospitals soon after they were transferred from army hospitals. The World War II veteran was sent to a veterans hospital nearest his home directly from the army. While he was a soldier, he followed orders and went wherever he was directed. His discharge from the army became effective upon his admission to the veterans hospital. In most instances the soldier was away from home a long time. He was tired of restrictions and discipline, was homesick and craved to be with his family again, permanently, not just for a visit.

It is easy to understand the man's state of mind that when the long-awaited day of his discharge from the army finally arrived, instead of being free again, he found himself once more away from home, restricted and regimented by the necessary but, nevertheless, distasteful routine of a tuberculosis institution. This was particularly irksome to the many World War II veterans who had early lesions, were practically symptom free, and who looked and felt well. It is not surprising that many of these men left the hospitals as soon as they acquired a civilian status and were free to follow their own inclinations. This condition was duly recognized and liberal allowances were made for granting leaves of absence to these patients. However, such privileges did not solve the problem in the majority of instances. This problem was, however, temporary and solved itself with the complete demobilization of the armed forces to a peace-time status.

Another frequent cause for veterans leaving hospitals of their own accord was a provision of the law which called for a considerable reduction in the pension when a patient without dependents entered a veterans hospital. This provision placed a premium on leaving the hospital against medical advice. Legislation to correct this situation was enacted by Congress in September 1946.

Generally speaking, the most common reasons why patients

leave civilian tuberculosis hospitals against medical advice are considered to be economic. Among war veterans, however, the reasons are inherent in the laws governing the hospitalization of veterans. Paradoxically, the ease of admissions and readmissions to any one of the many veterans hospitals scattered throughout the country and the better economic condition of the average tuberculous war veteran by virtue of a pension, are responsible for a considerable percentage of irregular discharges.

These conditions are unavoidable and, though just, may be a handicap to some veterans in the same nature as the excessive wealth of a parent is at times to a child.

To a non-veteran tuberculous patient, only one, rarely two, sanatoriums are available in his respective state. Admissions to the institutions that are available can be secured, in most instances, only after a long interval of waiting. To the tuberculous war veteran there are available many tuberculosis hospitals scattered over the country, some of them situated in the most beautiful locations and in the most pleasant climates. They are quite a temptation to a foot-loose individual, particularly since he knows that admission of a war veteran with active tuberculosis to any one of these beautiful institutions is practically mandatory. All a war veteran with active tuberculosis has to do to gain admission to a Veterans Administration tuberculosis hospital is to enter the front door and present evidence to prove that he is a bonafide war veteran.

Should a non-veteran tuberculous patient with limited funds become tired of the monotony of a tuberculosis institution and venture away from his home state, he will most surely become stranded in a strange land without friends and without eligibility for admission to a sanatorium for free treatment. It may be said without equivocation that there is probably no sanatorium in the country, whether state, county, municipal or private, which would admit such a patient coming to its doors. Furthermore, a war veteran has a host of loyal and helpful friends among the veterans service organizations all over the country and his funds are regularly augmented by the government in the form of pensions.

These conditions allow for the greater mobility of the veteran to follow an urge for a change of place or climate in search for the mythical land where, he believes, he may be cured by merely inhaling the "health-giving" air.

All possible measures are being undertaken by the Veterans Administration to solve the problems of the tuberculous war veteran. Whenever necessary and possible, laws are being amended toward that end. A very comprehensive follow-up system and a

case registry for tuberculous war veterans have been established and contact will be maintained with all tuberculous veterans, either directly or through the local health agencies. It can be seen, however, from the very nature of the problems, that the Veterans Administration alone cannot solve all of them. This requires the concerted efforts of the state and local health and welfare agencies in cooperation with the Veterans Administration. It is, for instance, beyond the jurisdiction of the Veterans Administration to enforce hospitalization, impose quarantine, examine contacts or indoctrinate members of the family. It is apparent then, that the state and local health and welfare agencies must step in where the Veterans Administration must leave off.

It is hardly necessary to emphasize that an open case of pulmonary tuberculosis is more dangerous epidemiologically than a case of diphtheria or scarlet fever. While the area menaced by these exanthematous diseases is usually limited by the acuteness of the disease to the patient's home, the area menaced by the open case of pulmonary tuberculosis is as wide as is his ability to travel.

Compulsory hospitalization laws for pulmonary tuberculosis have been adopted in several states in order to control the movements of open cases of pulmonary tuberculosis. This will, undoubtedly, have a tendency to prevent patients from leaving the institution against medical advice in many instances. To expect, however, that similar laws would be enacted in all the 48 states within a reasonable time, would be unduly optimistic. Experience has shown that serious problems of national scope frequently require federal laws for their solution. The need for periodic mass x-ray examinations of the entire population of the country is obvious and not beyond reach.

Simultaneously, hospitalization facilities must be provided to accommodate all active cases of pulmonary tuberculosis as soon as the disease is discovered. Without this, a compulsory hospitalization law has no meaning.

A more active and aggressive nation-wide educational campaign against tuberculosis is urged. It should be conducted not only among the various communal groups but it should be aimed particularly at the legislators, strongly emphasizing the communicable nature of the disease, the importance of continuity of treatment and the comparative ease with which it could be controlled by appropriate measures. There should be no hush-hush about a patient with active pulmonary tuberculosis who refuses hospital care, and whose home conditions and supervision are not considered adequate by competent authority.

Intramural Measures

Indoctrination of tuberculous patients in the nature and treatment of tuberculosis is recognized as a fundamental necessity. All other intramural measures designed to uphold the morale of these patients have been heretofore almost exclusively of a recreational nature. The conventional occupational therapy, consisting of various arts and crafts, a circulating library, radio broadcasts and motion pictures are employed in almost all tuberculosis institutions as a diversion to break up the monotony of a long period of hospitalization and to discourage discharges against medical advice. And yet almost one-third of the discharged patients left against medical advice in 1946 from 41 civilian tuberculosis hospitals in a well organized community like metropolitan New York.

There is no stereotyped method for the management of tuberculous patients. The methods have to be varied with the intelligence, educational and cultural background and the ambition of the individual patient. Heretofore, the program did not take this sufficiently into account. It is particularly important to bear this in mind when dealing with World War II veterans, the vast majority of whom are in their twenties.

The intelligent person, whose mental processes are not impaired by the toxemia of an acute febrile disease or by severe bodily discomfort, finds it difficult to lead the vegetative life necessitated by the prolonged bed rest in the treatment of pulmonary tuberculosis. As desirable as complete physical and mental relaxation is, we must recognize the fact that the average young tuberculous patient cannot stop thinking of the present, the future, and the most valuable years which are being extirpated from his life. This large group represents a reservoir of salvable human material which has not been heretofore adequately tapped. We should give due cognizance to this important group and adjust the management of their cases accordingly.

While the value of complete mental and physical rest in the treatment of tuberculosis cannot be disputed, the inflexible enforcement of the universally adopted rule which prohibits to all patients even reading during certain rest hours, is neither possible nor wise. In many cases, mental and physical relaxation can be more easily and effectively secured while reading an interesting book in a semi-reclining position than while trying to fall asleep in the daytime, which, if successful, would only make sound sleep at night more difficult. A book is frequently the antidote against far more disturbing thoughts. Individualization should be the keynote in applying even the all-important rest cure.

When the disease has come under control and has ceased progressing, the patient still has a long period of hospitalization ahead of him. As long as the lesion is retrogressing it is still unstable and is therefore considered active. Meanwhile, the patient has a sense of well-being which is at times a handicap. He chafes under the inactivity and is apt to leave the hospital prematurely. His energies must, therefore, be directed towards useful pursuits which will have a bearing on his future aims and ambitions, and will also be an added inducement to remain in the hospital until the completion of treatment.

Since the treatment of pulmonary tuberculosis is usually a matter of years, mental and spiritual deterioration are apt to take place and a sense of frustration is likely to result.

It is particularly vital to recognize this situation when dealing with a person in the twenties, a period when the foundation for the future economic life is usually laid. When a patient of this age spends several years in complete idleness, it may, and frequently does, change his entire outlook on life. He sees himself caught in an eddy going endlessly and aimlessly around and around, while the main stream of life is passing by him and flowing onward to greater opportunities. Under such conditions he is apt to disregard the sound, but less alluring advice of his physician, and is apt to leave the hospital of his own accord.

It is not enough to provide such a person with the usual occupational therapy in the form of some crafts or with some light reading matter. This is amusing to some extent, but a healthy and virile mind cannot continuously subsist on such poor mental fare.

Man's two greatest fears are invalidism and dependency. When a person first learns he has tuberculosis, he is suddenly confronted with these two over-powering spectres, and worry over one aggravates the other, thus creating a vicious cycle. These two problems are so mutually interdependent that for best and surest results both should be tackled simultaneously.

In order to prevent the patient from lapsing into a state of mental stagnation and from losing years of valuable time, to stimulate his lagging morale and to provide an added incentive to remain in the hospital until his tuberculosis is arrested, it is necessary to start him on the road towards his rehabilitation almost simultaneously with the medical treatment.

In most cases, a reorientation of the man's place in society and a complete revision of his plans for the future are necessary on account of his handicap. Expert guidance is as essential for this as for his medical condition. To leave his rehabilitation to chance

is as impractical and unscientific as to leave the management of his medical treatment to his own devices

With these ideas in mind, there was organized on the Tuberculosis Service of this hospital, in November 1945, a rehabilitation team consisting of a trained vocational counsellor, an academic instructor, the social worker, and the ward physician

Each patient found physically suitable was given an interest test, an aptitude and other indicated psychometric tests. If considered qualified for some academic or commercial studies the patient was offered every encouragement and opportunity to pursue the selected subjects with the help and guidance of the instructor

Subsequently when a rehabilitation program was established by the Veterans Administration in all hospitals under its control, the hospital rehabilitation committee was broadened to include, in addition to the members mentioned above, the Physician in Charge of Medical Rehabilitation Section as well as representatives of other departments concerned with the various phases of rehabilitation

The training of patients has been carried out under a staff of full-time instructors and a great variety of subjects are offered to suit different patients according to their individual tastes, tendencies, training, education and culture. Diversification is very important if we are to take full advantage of our rehabilitation program and interest in it the greatest number of patients

Under educational therapy the most popular subjects are those leading towards a high school diploma with special emphasis on English and mathematics. About twelve of our patients have been awarded high school diplomas thus far. Among the commercial subjects, bookkeeping, typing, and stenotyping are the most popular. Business law, stenography, and salesmanship are also offered. Fine arts and mechanical drawing are diligently studied by a group under an exceptionally well qualified instructor. Other patients are being trained in radio and motion picture projector repair and a class in watch repairing is being organized.

Since most World War I veterans are in their upper fifties they are not likely to be fit for rehabilitation. Diversional occupational therapy is available to this group of patients either on the ward or in the occupational therapy shops.

It was very gratifying to note the marked improvement in the morale among patients when the present program of rehabilitation was first inaugurated in November 1945. Instead of drifting aimlessly they found themselves purposefully engaged with a definite object in view. It is relatively uncommon for a patient

who is following a planned rehabilitation program to leave the hospital of his own accord

All occupations are taken up with the view of fitting them into the eventual rehabilitation program which has been decided upon in each individual case. Thus, while still undergoing treatment for pulmonary tuberculosis, the patient can be advancing simultaneously toward his final goal which is complete rehabilitation

Conclusions

The modern tuberculosis institution is a great deal more than a place where only the disease is treated. Due to the long duration of hospitalization, the frequent paucity of symptoms and the fact that the majority of the patients are in their early adult years, it is important to give due consideration to the eventual aim of treatment, namely, restoration of the patient to as normal a working capacity as possible. It is necessary to utilize the patient's time and energies in useful pursuits which will be helpful towards his rehabilitation.

A well planned and well executed intramural program of rehabilitation, carefully integrated with the therapeutic regimen, designed to fit in with the post-hospital program of rehabilitation, is a vital function of the modern tuberculosis institution.

Rehabilitation should be started as early as possible after admission, consistent with the physical condition of the patient.

Skillful guidance is required to guard the patient from lapsing into the hypochondrical state of phthisiophobia, and this must be carefully balanced against the other extreme which is overconfidence to the stage of foolhardiness.

Treatment and rehabilitation are viewed as parts of one continuous program for the purpose of fitting the patient back into the social fabric as a useful, self-supporting, and self-respecting member of the community.

CONCLUSIONES

La institución moderna para tuberculosos es mucho más que un lugar donde solamente se trata la enfermedad. Debido a la prolongada duración de la hospitalización, a la frecuente escasez de síntomas y al hecho de que la mayoría de los pacientes se encuentran en los años adultos tempranos, es importante que se le dé la debida consideración al objeto final del tratamiento, a saber restaurar al paciente a una capacidad para trabajar tan normal como sea posible. Es necesario que se utilizen el tiempo y las energías del paciente en ocupaciones útiles que contribuyan a su rehabilitación.

Un programa de rehabilitación bien planeado y bien ejecutado,

integrado cuidadosamente con el régimen terapéutico, y concebido para que encaje con el programa de rehabilitación posthospitalario, es una función vital de la institución tuberculosa moderna

Debe comenzarse la rehabilitación tan pronto después de la admisión como sea posible, consistente con la condición física del paciente

Se necesita una dirección hábil para evitar que el paciente caiga en el estado hipocondríaco de la tísiofobia, y debe balancearse cuidadosamente esto con el otro extremo, la confianza en demasía que lleva a la temeridad

Se considera que el tratamiento y la rehabilitación son partes de un programa continuo cuyo propósito es el de restaurar al paciente a la sociedad como un miembro útil y pundonoroso de la colectividad que se gana su propia vida

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Tuberculosis Case-Finding Survey in Penal and Correctional Institutions in Ohio

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"There is, in fact, hardly an argument that can be advanced for the stern suppression of crime by penal methods that does not apply equally to the suppression of disease" ¹

Medical service in the penal and correctional institutions throughout the United States has been reported at various times to be below the level of medical care for the general population. In 1939 McCartney² noted that in 47 per cent of the 251 Federal and state prisons the medical service was of less than average quality and he predicted that in most cases the inmates would be released from prison in a worse physical state than when they were committed. In 1929 a survey³ of the Federal and state prisons was made in order to determine as closely as possible the extent of the tuberculosis problem. The findings revealed that approximately 1 per cent of the inmates were known to be infected with tuberculosis and intimated that a more complete examination would reveal a larger number of cases. It was also noted that care and treatment for tuberculous patients was extremely variable and was mainly valuable in providing isolation for the infected inmates.

Following a mass x-ray survey of the mental schools and hospitals in Ohio during the first four months of 1946 it was felt desirable that the survey be extended to include penal and correctional institutions.

The inmates and employees of two penal and two correctional institutions for males in the state of Ohio are the subject of this survey. Two other institutions for female inmates, one penal and one correctional were not included in the study because of inadequate power source for operation of roentgenographic equipment.

Photofluorographic equipment utilizing 35 mm unperforated film was the case-finding apparatus employed. Suspected tuberculous and nontuberculous lesions noted on small films were reexamined on 14" x 17" celluloid roentgenograms. The survey was conducted primarily as a screening project and recommendations were made for diagnostic follow-up in those cases where it was indicated.

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It is recognized that the specific diagnosis of tuberculosis cannot be made on the basis of x-ray evidence alone, but must depend on further clinical evaluation such as physical examination, sputum or gastric examination, and tuberculin testing. In order to qualify the findings in the light of the necessarily incomplete investigative method, cases which were considered to represent possible x-ray evidence of tuberculosis were referred to as suspected tuberculosis and were classified according to the stage of the presumable activity of the disease. This method of mass examination was deemed sufficiently reliable for the purpose of statistical analysis and an estimation of the need for tuberculosis control.

Inasmuch as 9 per cent to 11 per cent of the prison inmate population are released annually and approximately 96 per cent become eligible for release from the penal and correctional institutions of Ohio,⁴ it is manifest that the return of unknown and undetected cases of infectious tuberculosis to their respective communities constitutes a serious public health hazard.

Analysis of Material

TABLE 1
GENERAL INFORMATION — PENAL SURVEY

	Number	Per Cent
Total Population	8619	100.0 of Total Population
Inmates	7920	91.9 of Total Population
Employees	699	8.1 of Total Population
Total Screened	7763	90.1 of Total Population
Inmates	7123	89.9 of Total Inmates
Employees	640	91.6 of Total Employees
Total Retakes	500	6.4 of Total Screened
Inmates	445	6.2 of Inmates Screened
Employees	55	8.6 of Employees Screened
Total Suspected Tuberculous	252	3.2 of Total Screened
Inmates	237	3.3 of Inmates Screened
Employees	15	2.3 of Employees Screened
Total with Other Pathology	95	1.2 of Total Screened
Inmates	87	1.2 of Inmates Screened
Employees	8	1.2 of Employees Screened
Total Negative	7416	95.5 of Total Screened
Inmates	6799	95.4 of Inmates Screened
Employees	617	96.4 of Employees Screened

The total number of individuals examined was 7,763 or 90.1 per cent of the total population. Of these, 7,123 or 89.9 per cent of the total inmate population and 640 or 91.6 per cent of the total employee population were screened. The number of cases revealing suspected tuberculous lesions on the initial x-ray films was 252 or 3.2 per cent of the total persons x-rayed.

Two-hundred-thirty-seven or 3.3 per cent of the inmates examined were considered suspected tuberculous and 15 or 2.3 per cent of the employees had x-ray evidence of suspected tuberculosis, these are rates approximately three and two times greater respectively than those noted in general industrial population surveys.^{5,6}

TABLE 1a
NUMBER AND PERCENTAGE OF CASES OF OTHER
PATHOLOGIC CONDITIONS BY POPULATION

	N U M B E R			PERCENTAGE DISTRIBUTION		
	Inmates	Employees	Total	Inmates	Employees	Total
				Per Cent		
Total	87	8	95	100.0	100.0	100.0
Aortic	5	0	5	5.7		5.2
Cardiac	9	2	11	10.4	25.0	11.6
Diagnosis Deferred	44	3	47	50.6	37.5	49.5
Other Diseases	5	1	6	5.7	12.5	6.3
Pleurisy	24	2	26	27.6	25.0	37.4

A significant finding incidental to the search for tuberculosis was the occurrence of 95 cases of suspected nontuberculous pathology, a number which represents 1.2 per cent of the total number screened.

The distribution of suspected tuberculosis by stage of the disease varied considerably between inmates and employees, 53.1 per cent of the tuberculous inmates had minimal disease, whereas only 26.7 per cent of the suspected tuberculous employees were in this stage, 30 per cent of the suspected tuberculous inmates and 20 per cent of the suspected tuberculous employees were moderately advanced, and 5.5 per cent of suspected tuberculous inmates and 6.7 per cent of suspected tuberculous employees were far advanced. A notable difference was found among those persons with reinfection, stage unknown, in which cases some form of operative treatment for the disease had been taken at a prior date, 6.3 per cent of the suspected tuberculous inmates and 13.2 per cent of the suspected tuberculous employees were in this group.

TABLE 2
NUMBER AND PERCENTAGE OF SUSPECTED CASES
DISCOVERED — BY STAGE OF DISEASE

Total Suspected Tuberculous				
252 (3.2 per cent) of Total Population Screened				
Total Suspected Tuberculous Inmates				
237 (3.3 per cent) of Total Inmates Screened				
Total Suspected Tuberculous Employees				
15 (2.3 per cent) of Total Employees Screened				
		Number	Percentage	Corrected Combined Percentage
Primary with Activity	Inmates	1	0.4	
	Employees	0		0.4
Minimal	Inmates	126	53.1	
	Employees	4	26.7	51.4
Moderately Advanced	Inmates	71	30.0	
	Employees	3	20.0	29.4
Far Advanced	Inmates	13	5.5	
	Employees	1	6.7	5.5
Reinfection, Stage Undetermined	Inmates	15	6.3	
	Employees	2	13.2	6.7
Pleurisy with Effusion	Inmates	3	1.3	
	Employees	0		1.2
Suspected Tuberculosis, Unclassified	Inmates	8	3.4	
	Employees	4	26.7	4.8
Suspected Silicosis with Infection	Inmates	0		
	Employees	1	6.7	0.4

The institutional personnel screened numbered 7,763, the white population numbered 5,476 or 70.54 per cent of the total, the colored population was 2,286 or 29.45 per cent of the total, 1 or 0.01 per cent was classified as other. Colored inmates had an incidence of 2.9 per cent as compared with an incidence of 3.5 per cent for white inmates. Advanced disease among the colored inmate population was 46.3 per cent as compared with 31.2 per cent among the white inmate population.

The occurrence and distribution of suspected tuberculosis by age groups revealed 68.8 per cent of the disease occurring in the inmate group under 45 years and 60 per cent of the suspected

TABLE 3

NUMBER AND PERCENTAGE OF CASES OF SUSPECTED
TUBERCULOSIS AND NON-TUBERCULOUS
CONDITIONS BY COLOR

Total	5476	2286	1			
Inmates	4847	2275	1			
Employees	629	11	0			
<i>Suspected Tuberculosis</i>						
	No	Per Cent of Whites Screened	No	Per Cent of Colored Screened	No	Per Cent of Others Screened
Total	184	3 4	68	3 0	0	
Inmates	170	3 5	67	2 9	0	
Employees	14	2 2	1	9 1	0	
<i>Non-Tuberculous Conditions</i>						
Total	64	1 2	31	1 3	0	
Inmates	56	1 2	31	1 4	0	
Employees	8	1 3	0		0	
<i>Negative</i>						
Total	5228	95 4	2187	95 7	1	100 0
Inmates	4621	95 3	2177	95 7	1	100 0
Employees	607	96 5	10	90 9	0	100 0

tuberculosis among employees was noted in the age group over 45 years. This dissimilarity may be accounted for by the fact that, during the war years particularly, a large proportion of the employee population hired or retained was in the older age groups.

Discussion

The immediate objective of this survey in the penal and correctional institutions was to determine the extent and character of the problem of tuberculosis among these wards of the state of Ohio.

The increased prevalence of the disease which was anticipated in this special population group was borne out by the finding of 237 suspected cases among 7,123 inmates screened or a rate of 33 per thousand, which is approximately three times greater than that found in the general population group. The hazards attendant

TABLE 4

NUMBER AND PERCENTAGE OF SUSPECTED CASES DISCOVERED
ALL STAGES OF THE DISEASE — BY AGE GROUP

Age	INMATES		EMPLOYEES		T O T A L	
	No	Per Cent	No	Per Cent	No	Per Cent
1 to 4	0		0		0	
5 to 14	0		0		0	
15 to 24	31	13.1	0		31	12.3
25 to 34	76	32.1	3	20.0	79	31.3
35 to 44	56	23.6	3	20.0	59	23.4
45 to 54	42	17.7	3	20.0	45	17.9
55 to 64	24	10.0	6	40.0	30	11.9
65 or over	7	3.0	0		7	2.8
Unknown	1	0.4	0		1	0.4
TOTAL	237	100.0	15	100.0	252	100.0

to concentration of the disease in segregated areas appears to be reflected in the finding of 15 suspected cases among the employees or a rate of 23 per thousand, approximately twice that found in community surveys

A program of tuberculosis control for penal and correctional institutions is by its nature, beset by many complexities. Not the least of these, is the establishment and maintenance of case-finding procedures. For maximum effect it is necessary that all new admissions and new employees receive a complete examination including tuberculin test and chest x-ray.

It is consistent with reason that the localities to which the inmates of these institutions return upon release may expect healthy, rehabilitated citizens. Prisoners have a fundamental right to the preservation of their health through the exercise of reasonable care, prevention, as well as treatment should be employed for preservation of their physical integrity. It should also be apparent that institutional employees should not be exposed to an entirely preventable disease.

Bettag⁷ cites the recognition of the problem in thirty-four states, but concludes that "few states, however, have adequate control programs." In view of the technical advances in our knowledge of tuberculosis control within the past few years, this dilatory attitude on the part of state government seems inexcusable. The salvage of lives and the protection of the public health far outweigh any economic opposition which may be advanced for not establishing a modern control program for penal and correctional institutions.

SUMMARY AND CONCLUSIONS

1) A photofluorographic survey conducted in two penal and two correctional institutions in Ohio revealed 237 cases of suspected tuberculosis among 7,123 inmates screened or an incidence of 3.3 per cent. Among 640 employees x-rayed there were 15 individuals with suspected disease or an incidence of 2.3 per cent.

2) Fifty-three and one-tenth per cent of suspected disease detected in inmates was in the minimal stage, while 26.7 per cent of suspected disease in employees was in this stage. Presumably advanced tuberculosis was noted in 35.5 per cent of suspected tuberculous inmates and 26.7 per cent of suspected tuberculous employees. Thirteen and two-tenths per cent of cases among employees were classified as reinfection, stage unknown and 6.3 per cent of cases among inmates were so classified.

3) Prison wards of the state have reason to expect and should receive good preventive and curative medical care. Employees of state penal and correctional institutions are entitled to a reasonably healthful working environment.

4) A program of tuberculosis control should be inaugurated in the penal and correctional institutions which shall include physical examination, chest x-ray films and tuberculin testing of all new admissions and new employees. Annual chest x-ray examination of the entire institutional personnel should be made a part of the medical service routine.

6) A central hospital facility should be constructed for the care and treatment of active cases of tuberculosis from the penal and correctional institutions. Observation pavilions for isolation and diagnostic follow-up of questionably active cases should be established in each institution.

RESUMEN Y CONCLUSIONES

1) Un censo roentgenfotográfico que se llevó a cabo en dos instituciones penales y dos correccionales de Ohio reveló 237 casos de tuberculosis sospechada entre 7,123 reclusos examinados, o sea una frecuencia del 3.3 por ciento. Entre 640 empleados radioscopiados se encontraron 15 individuos con enfermedad sospechada, o sea una frecuencia del 2.3 por ciento.

2) El 53.1 por ciento de la enfermedad sospechada que se descubrió entre los reclusos estaba en el período mínimo, mientras que el 26.7 por ciento de la enfermedad sospechada entre los empleados estaba en ese período. Se notó lo que se supuso ser tuberculosis avanzada en el 35.5 por ciento de los reclusos en los que se sospechó tuberculosis y en el 26.7 por ciento de los empleados igualmente sospechados. El 13.2 por ciento de los casos entre los

empleados fueron clasificados como de reinfección de período desconocido y el 63 por ciento de los casos entre los reclusos fueron clasificados así también

3) Los reclusos de las prisiones del Estado merecen y deben recibir buena atención médica, tanto profiláctica como curativa. Los empleados de instituciones penales y correccionales del Estado tienen derecho a que su ambiente de trabajo sea razonablemente saludable

4) En las instituciones penales y correccionales se debe inaugurar un programa de control de la tuberculosis que debe incluir examen físico, películas radiográficas del tórax y pruebas a la tuberculina de todos los nuevos reclusos y empleados. Exámenes radiográficos torácicos anuales del personal entero de la institución debe formar parte del servicio médico sistemático

5) Debe construirse un hospital central para el cuidado y tratamiento de casos activos de tuberculosis provenientes de las instituciones penales y correccionales. En cada institución se deben establecer pabellones de observación para aislar y diagnosticar a los casos de dudosa actividad

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The Value of Electrocardiography

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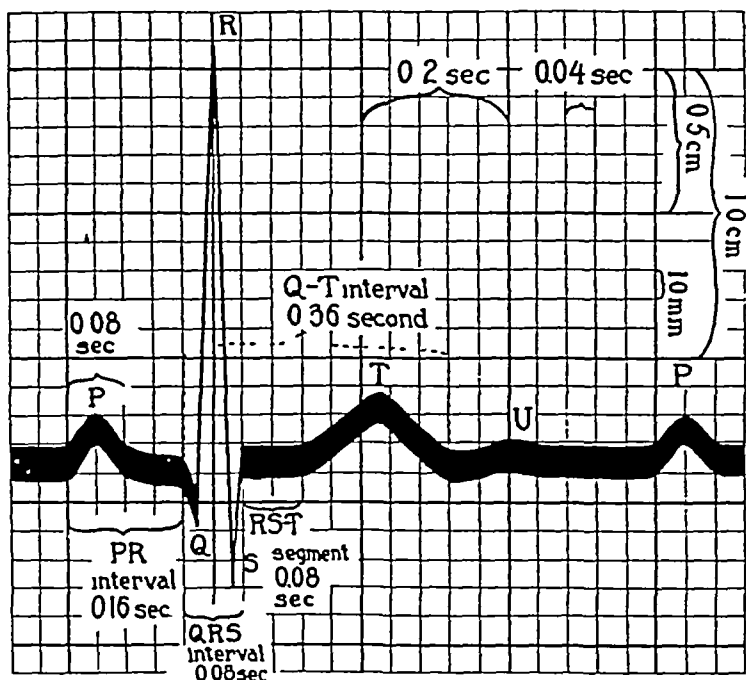
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The electrocardiograph is an instrument for the graphic registration of the heart beat. This is done by applying the electrodes of the electrocardiograph to the right arm, the left arm and the left leg of the individual to be studied. In recent years a fourth electrode has been used, and this is placed over the apex of the heart. The coupled electrodes of the right arm and the left arm are known as lead one (L_1), those of the right arm and the left leg are known as lead two (L_2), and those of the left arm and the left leg are known as lead three (L_3). The precordial lead or the electrodes connecting the apex of the heart and the left leg is known as lead four (L_4). There are a great many positions for this precordial electrode each one having a specific purpose in the investigation of cardiac disease.

The electrical action current associated with heart muscle contraction is picked up by these electrodes and brought back to the string of the galvanometer contained in the electrocardiograph. This particular string is suspended in an electromagnetic field, and the string in turn is interlaced between a light and a photographic film. Thus the string's shadow is cast upon a photographic film. Between the string and the photographic film is a timing device, so that when the record is taken, the various time components are recorded during the film exposure. The electrical current that enters the string galvanometer disturbs the electromagnetic field with the result that the string is deflected. This deflection casts a shadow upon the photographic film and a tracing is formed. This tracing is known as the electrocardiogram and the science of producing this type of record is known as electrocardiography. The individual who interprets the electrocardiogram is known as an electrocardiographer. As a result of this graphic registration we obtain the accompanying type of record (Fig 1). The record consists of a series of complexes made up of P waves, QRS waves, and T waves. There is no significance to be attached to the letters used in describing the complexes on the electrocardiogram. They were chosen because they had not been used heretofore in physiological experiments. The P wave represents the action current of the auricle, the QRS wave that of the ventricle, and the T wave the dying out of the current of action. In

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addition, the time required for the passage of this current through the various portions of the heart is registered upon the electrocardiogram. The time required for it to pass from the auricle to the ventricle is known as the PR interval and it should not exceed two tenths (0.2) of a second. The time required to pass through



the ventricle is known as the QRS interval, and it in turn should not exceed one tenth (0.1) of a second. A series of these complexes constitute the electrocardiogram. The record is further divided into those complexes that are obtained from lead one, lead two, lead three and those from the various precordial leads.

Once having obtained such a graphic registration of the cardiac cycle what information may we obtain from the record? We may obtain the following unequivocal information: (1) the rate at which the heart was beating at the time the electrocardiogram was taken, (2) the individual time components of the various complexes on the record, (3) the rhythm of the heart at the time the record was made, and (4) the presence or absence of normal complexes. It is when the complexes deviate from normal that an interpretation of the record becomes necessary, and it is at this time that clinical judgment and experience is essential. The complexes are altered whenever there is a disturbance of myocardial function. These disturbances may result from such con-

ditions as infection in the myocardium, impoverished blood supply to the myocardium, parasitic infection in the myocardium or from metastatic tumors to the myocardium. It is possible for the record to be disturbed, whenever there is a disproportion between the muscle bulk of the left and right ventricles. More important, however, is the fact that the record may register myocardial changes that are extra cardiac in origin. Such phenomena may be present in thyrotoxicosis, myxedema, chronic gallbladder disease, duodenal ulcers and the like. It is obvious then that the electrocardiograph records only the cardiac cycle, and in doing so it also records altered complexes should there be a disturbance in the myocardium. The electrocardiograph, however, cannot tell us what produced the change in the myocardium, nor can it distinguish between the many things that can make such myocardial changes. It is true, that although a single electrocardiographic tracing may not be of significance, serial records are of inestimable value, for often the changes in the record or the patterns presented in the tracing may be sufficiently pathognomonic for the interpreter to accurately diagnose the cardiac lesion present. It is possible also that a great deal of damage may exist in both the right and the left ventricles, and so counteract each other that the electrocardiogram will be perfectly normal, and yet the heart can be abnormal from a clinical standpoint. The converse is also true, namely, that in a clinically normal heart, there may be marked electrocardiographic changes. From this, we may state that electrocardiographic heart disease does not represent clinical heart disease, and that severe forms of clinical heart disease can exist in association with a normal electrocardiogram. The electrocardiogram, therefore, cannot give us a prognosis concerning heart disease, it cannot tell us the functional capacity of the heart, and it cannot diagnose heart disease. All that we obtain from the electrocardiograph is a graphic record of the heart cycle. The value of this record is then dependent not only upon the electrocardiographer's skill in making the interpretation, but also upon his knowledge concerning the clinical course of the individual's illness. The electrocardiographer records what he sees in the electrocardiogram. Since it is possible that the interpretation of the recorded facts may not correspond with the clinical course of the patient, it is necessary for the physician to be able to apply and to evaluate the interpretation in terms of the clinical history and findings of the patient being studied.

SUMMARY

In conclusion, it may be stated that the electrocardiogram is a very valuable instrument to aid in the diagnosis and manage-

ment of patients with heart disease Its value depends upon a skilled interpretation of the record as well as a careful and proper correlation of this interpretation with the clinical course of the patient being investigated The instrument is not at any time a substitute for a well taken history, nor for a well made physical examination, and certainly it is not a substitute for other forms of laboratory procedure in the study of heart disease It cannot replace clinical experience and clinical judgment Further, it must be emphasized that electrocardiographic heart disease is not synonymous with clinical heart disease, and also that very severe clinical heart disease can exist in the presence of a perfectly normal electrocardiographic tracing Although the electrocardiogram may be of inestimable value in the study of cardiac disease, it must still remain as an adjunct to the clinical study of such phenomena

RESUMEN

En conclusión, se puede afirmar que el electrocardiograma es un instrumento valioso que ayuda en el diagnóstico y tratamiento de pacientes con enfermedad del corazón Su valor depende de una interpretación perita del trazo y de la correlación cuidadosa y correcta de esta interpretación con el curso clínico del paciente que se está investigando El instrumento nunca reemplaza a la historia bien tomada, ni al examen físico bien hecho, y ciertamente no reemplaza a otros procedimientos de laboratorio empleados en el estudio de enfermedades del corazón Tampoco puede reemplazar a la experiencia y al juicio clínicos Además, se debe recalcar que enfermedad electrocardiográfica del corazón no es sinónima a enfermedad clínica del corazón y, también, que puede existir muy grave enfermedad clínica del corazón cuando el trazo electrocardiográfico es perfectamente normal Aunque el electrocardiograma puede ser de valor inestimable en el estudio de las cardiopatías, debe ser siempre un adjunto al estudio clínico de esos fenómenos

Asbestosis

VI Analysis of Forty Necropsied Cases*

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During the past eighteen years the necropsy studies at the Medical College of South Carolina have included forty cases in which asbestosis of some degree has been encountered. In this period several reports¹⁻⁵ have been published.

Since various previous writings give extensive presentations of the industrial relations, clinical manifestations, roentgenological diagnosis and pathology of the disease, the scope of this paper will be limited to such additional information as may be gained in relation particularly to uncleared questions.

A division of these forty cases into three groups based upon the estimated grade of pulmonary fibrosis (Figs 1, 2 and 3) is given in Charts I, II and III. So far as possible the duration of exposure has been ascertained but that important information is missing in many of the histories. Where possible it was supplied by the employer. All traced exposure was in an asbestos factory where prior to the time of recognition of asbestosis as an industrial hazard the working conditions were undoubtedly very dusty, but where dust control has been progressively improved in the last twenty years or so and where conditions for work are recently as good no doubt as technical circumstances will allow. In Chart I, covering cases of minor asbestosis, there is one conspicuous case (49037) of failure of history of exposure to fit the disease state. There is nothing to indicate that this man actually worked ten years in asbestos dust, and the history of ten years exposure must be doubted. In case 70964 a nodular fibrosis of the lungs was also present, in reality excluding the case from comparison. Case 15652 is included in the discussion of tuberculosis in the series. Otherwise this group showed only incidentally the finding of asbestosis. Even the employment which caused it escaped the history of the

In Chart II, listing cases of well developed but not advanced asbestosis, is encountered a conscious relation of the employment exposure in connection with the case, although really in most of

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these cases the history of the employment was traced out after the necropsy diagnosis. The shortest known exposure to cause this grade of lung fibrosis was twenty-eight months during an elapsed three years. The fibrosis was naturally of recent formation. In general the advance of the disease and the age of the lung fibrosis parallels the duration of exposure and the length of time since

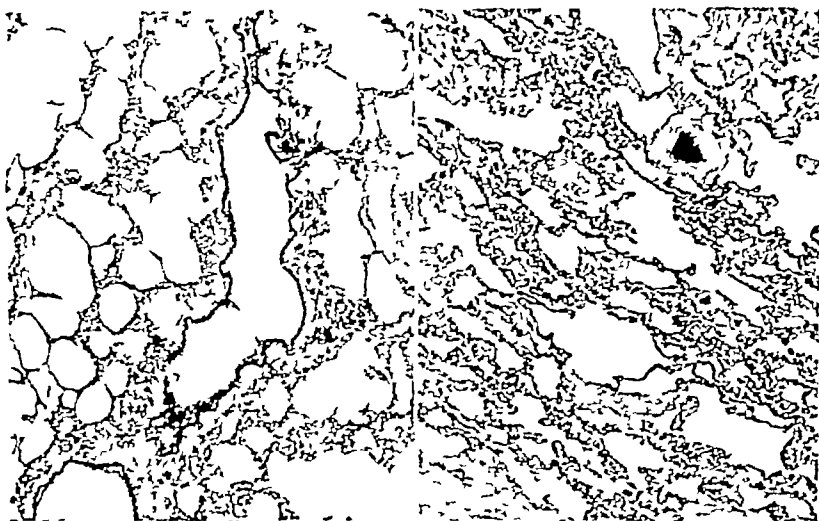


FIGURE 1

Figure 1 Grade 1 asbestosis Human lung, X 75

FIGURE 2

Figure 2 Grade 2 asbestosis Human lung X 75

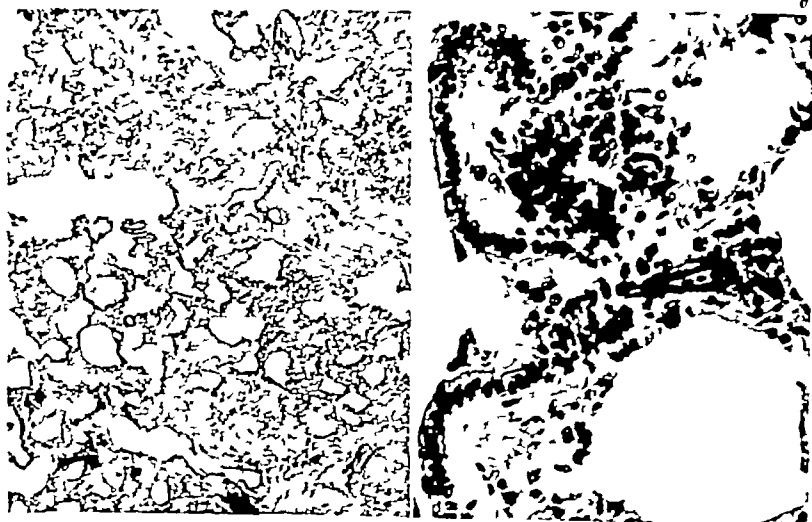


FIGURE 3

FIGURE 4

Figure 3 Grade 3 asbestosis Human lung X 75—Figure 4 Asbestosis bodies located in terminal bronchiole and vestibular area Human lung X 525

CUTANEOUS MINOR GRADE—12 CASES

No	Sex & Age	Exposure	Abscesses	Old	F	I	B	R	O	S	I	S	Pleura	Major Disease
10672	M 32	No Data	++				+						++	Encephalitis, Acute
11726	M 50	No Data	+	+									+	Aortic Insufficiency, Cor Sclerosis
12892	F 29	No Data	++				+						+++	Pulmonary Tuberculosis
15652	M 32	No Data	+		+									Typhoid
20532	F 80	No Data	+		+									Arterioscl Gangrene of Feet
30514	M 35	No Data	++		+									Arterioscl Cerebral Hemorrhage
30678	F 35	No Data	+		+								+	Sarcoma of Uterus
36007	M 45	No Data	+		+								+	Drowned
48619	F 36	No Data	+						+					Carcinoma of Groin
49037	M 28	10 yrs ?	+		?									Endocarditis
70964	M 50	No Data	++	+	+							++	++	Arterioscl, Pneumonia
50454	M ?	No Data	+						+					Injury

CHART II — MEDIUM GRADE — 14 CASES

No	Sex & Age	Exposure	Asbestos Bodies	Old	F	I	B	R	O	S	I	S	Plasma	Major Disease
9647	M 40	28 mos in 3 yrs	++			++								Gunshot
10944	F 40	No Data	+	++									++	Pelvic Abscess
11511	F 55	No Data	++	+		++							+	Cor Sclerosis
11613	M 62	No Data	+	++		++								Arterioscl Cerebral Hemorrhage
11837	M 40	No Data	+++	++		++								Carcinoma of Neck
11967	F 45	No Data	++	++						+			++	Arterioscl
17726	M 44	No Data	+++	++						?				Mesenteric Thrombosis
18062	F 65	No Data	++	++		+				+			++	Aortic Aneurysm
20186	F 36	4 yrs 14 yrs before	+	++		+				+			+	Aortic Aneurysm
22047	M 30	4 yrs 3 yrs before	+++	+		++							++	Pulmonary Tuberculosis
25237	M 45	13 yrs 3 yrs before	++	++		+				+			++	Pulmonary Carcinoma
40916	M 37	No Data	++	++						+				Aneurysm
47715	M 37	10 yrs 1 yr before	++	+										Gunshot
66100	M 50	22 yrs 1 yr before	+++	++		++							+	Pulmonary Carcinoma

its beginning. Also the prominence of asbestosis bodies in the lungs is generally consistent with the duration of exposure. In this group appears two of the three cases of cancer of the lung which are especially presented in another place. There is no other indication in this chart that asbestosis of this degree is directly or indirectly responsible for death of the subject.

In Chart III, showing data on the fourteen advanced cases of the series, is seen the first positive evidence of the direct killing effect of the disease. At least four of the cases show a major part played by pulmonary fibrosis in the death of the individual. In the few cases where other factors responsible for the appearance of recent cellular fibrosis of the lungs could be ruled out, there is evidence to support Gardner's⁶ experience with experimental asbestosis in guinea pigs that the fibrous disease does not progress indefinitely after cessation of exposure. There are five cases of known but not recent exposure, for instance cases 147595 and 25145, Chart III, showing advanced old fibrosis but none recent. There are twelve cases all told showing old but not fresh fibrosis. On the other hand, recent exposure, no matter of how long the duration, characteristically shows fresh fibrosis (see cases 9676 and 10392, Chart III).

The "Asbestosis Body"

The so-called asbestosis body has become a characteristic element in human asbestosis and is also found in the lungs of some animals which have been the subjects of experimental asbestos dust exposure⁶ but not in others. It consists of a central asbestos fibre with a shiny yellow-brown coating appearing in a variety of architectural forms. Similarly coated bodies of smaller size may be found in silicosis and in miscellaneous occurrence of no apparent relation to asbestos dust exposure.⁴

The location of asbestosis bodies (Fig 4) in the terminal bronchioles and in the vestibular area of the lobule is significant in the pathogenesis of the disease. Those of smaller size appear in the peribronchial lymph nodes, where there is foreign body reaction but usually little if any fibrosis.

Time will not here permit full discussion of all matters of interest about these bodies. From previous publications it may be said that their formation is not an essential in the pathogenesis of experimental asbestosis in some animals although it is a characteristic microscopic feature in the naturally occurring human disease. Injury to the lung by the asbestos fibre occurs experimentally before the coating deposits in some animals⁷ and without it altogether in others. It appears that the coating may be a defensive occurrence, segregating the fibers from direct tissue

contact From study of the history of these cases it is apparent that these bodies remain deposited in the lungs more or less permanently, at least for as long as twenty-seven years (Fig 5, case 147595, Chart III) That they undergo slow but definite change is also apparent³

Findings of these bodies in the sputum is indicative of nothing more than the fact of previous inhalation of asbestos, not of the condition of the lungs They are usually more numerous in cases of current or recent long exposure They may be found for years after the cessation of such exposure, but in even advanced asbestosis of long duration they may not be found at all or only in sparse numbers Since nothing valuable is to be gained from lung puncture for examination of pulmonary material for these bodies that cannot be obtained by simpler measures, there seems to be no justification for that procedure as a measure to be used in diagnosis

Pleural Fibrosis

One of the outstanding features of disease encountered in advanced asbestosis is pleural thickening and more or less adhesive obliteration of the pleural space Since the deposit of asbestos dust does not reach into the pleura, the reason for pleural fibrosis is not clear

That it is not an essential of the disease state is shown by some of our cases That it may be a secondary condition, possibly of



FIGURE 5

Figure 5 Asbestosis bodies within old fibrous and almost obliterated air spaces, from exposure 27 years previous (147,595) Human lung, X 525 —



FIGURE 6

Figure 6 Grade 3 asbestosis (147,595) No pleural fibrosis

basis in intercurrent or secondary infection is indicated by other cases. In case 147595, Chart III, for instance, although there was heavy asbestos deposit and associated advanced grade of old fibrosis from exposure known to have terminated twenty-seven years before death, apparently from asbestosis itself, the pleural area was quite normal (Fig 6). In sixteen of the forty cases there was no pleural fibrosis, even in six of the advanced cases there was none. In ten of those showing pleural fibrosis, there was some other lung disease upon which the pleural state may be blamed.

Nodular Fibrosis

In one of our previous reports² is cited a case (10392) of fatal fibrosis of the lungs from eleven and one-half years asbestos dust exposure. Associated with general pulmonary fibrosis in this case was the occurrence of localized hyaline nodules of scar tissue resembling silicosis. From the exhaustive history obtained in long observation of this man before he died, no exposure to silica dust was uncovered.

Later³ we reported a case of carcinoma of the lung in advanced asbestosis which also showed silicosis type hyaline fibrous nodules within which were shown asbestosis bodies. In that report we used the term "asbestosilicosis." The subject concerned had worked in an asbestos factory for twenty-one years and previously in a cotton mill for twenty-two years.

All told, our series contains eight cases in which nodular fibrosis occurs, five in the advanced group, two in the medium group, and one among those of minor grade. Gloyne⁹ also records and illustrates the occurrence of nodular fibrosis "resembling the silicotic whorl."

Although the reason for this prominent appearance of nodular fibrosis in our cases is not clear, we have previously assumed that an unknown silica dust exposure probably was involved.

However, the question of possible occurrence of nodular fibrosis in asbestosis is again raised by King, Clegg and Rae,⁸ who report that nodular fibrosis of the lungs occurred from experimental intratracheal injection of rabbits with asbestos fibre of fifteen or more microns in length, while diffuse fibrosis resulted from similar injection of fibre of 2.5 microns length. This is not in accord with Gardner's⁶ findings of wholly non-nodular diffuse fibrosis of the lungs in guinea pigs from inhalation of asbestos dust consisting of long fibre and practically no effect from dust of asbestos ground to eliminate long fibres. In experimental asbestosis of rabbits and guinea pigs there is the additional difference that similar, although smaller, asbestosis bodies are formed in the lungs of the latter but not in the former. King and his asso-

ciates thought that certain black pigment associated with the asbestos fibre in rabbit's lungs might represent a comparable formation. Since there are other indications of difference in response of different species to asbestos dust in Gardner's experiments, this question will have to be subjected to further examination before it can be proven that nodular fibrosis of the lungs may not occur in natural asbestosis of human beings.

Carcinoma of the Lung in Asbestosis

In 1935, we³ made a report of the occurrence of carcinoma of the lung in a case of asbestosis. Prior to that time there had been no particular reference to that disease in relation to dust exposure except, as there recalled, among the workers in the mines of the Erz mountains in Bohemia and Saxony. Published papers were cited laying suspicion upon radium examination and upon arsenic in the ore concerned. By 1939, when we reported a second, a total of eight cases of carcinoma of the lung in asbestosis had been recorded.

In various published papers in the meantime, additional cases have been reported and discussions made (see Gloyne,¹⁰ Egbert and Geiger,¹¹ Nordman,¹² Anderson and Dibble,¹³ Vorwald and Ellis,¹⁴ Klotz,¹⁵ Halleb and Angrist¹⁶ and Homburger¹⁷) some of which indicate a relationship of carcinoma of the lung to asbestosis and to silicosis, and some of which argue to the contrary.

In our necropsy service has been encountered an additional case making a total of three in forty cases of asbestosis during

period of eighteen years. This incidence of 7.5 per cent is to be compared with a general incidence of 1 per cent of carcinoma of the lung in 2,683 necropsies in the last ten years. Of further interest in the question is the fact that each of our three cases had medium to advanced grades of asbestosis.

In addition to these necropsies we have recently had a case proven to be carcinoma of the lung by bronchoscopic biopsy in a man who had been exposed to asbestos dust irregularly for twenty years and who showed asbestosis bodies in his sputum. It may be interesting to compare this record with that of the experience of Klotz¹⁵ who reported four cases of carcinoma of the lung in fifty cases of silicosis during eleven years, an incidence of 8 per cent, and in a total of 4,500 autopsies during the same period the incidence of lung carcinoma was only 1.18 per cent.

Apparently to the present there are at least sixteen necropsied cases of carcinoma of the lungs in asbestosis, which, considering the comparatively small necropsy experience in the disease, seems excessive. From reports of the natural occurrence and from the question raised by experimental evidence, it seems that continued

effort, especially experimental, should be made to elucidate this important problem

Tuberculosis in Asbestosis

The question of whether asbestosis favors the development or progress of tuberculosis gains little evidence to support the affirmative here. Certain British reports indicate a high tuberculosis rate among asbestos workers and others do not. No acceptable proof of the contention in the form of properly controlled studies comparing tuberculosis in other groups of people living under a similar condition to the asbestos workers has been offered. On the other hand, Gardner reports from his experimental work that no influence upon tuberculosis occurred from asbestosis, and from surveys of asbestos workers no unusual incidence of tuberculosis has been found.

In our own series, from superficial analysis it might appear that tuberculosis had been favored by the condition. Six of the forty showed some form of active tuberculosis, an incidence of 15 per cent, while the incidence of occurrence of active tuberculosis in 2,683 necropsies during the same period was but 5 per cent.

A careful analysis of the individual cases, however, reveals that only four of the eight had active tuberculosis of the lungs. One of these (12192) had an advanced grade of pulmonary fibrosis showing the nodular localization characteristic of silicosis, which condition is well accepted as favoring the development of tuberculosis. Another (12892) had only a minimal and early grade of asbestosis. Of the other two, one (22047) exhibited a medium grade of asbestosis and one (19094) an advanced degree of old diffuse fibrosis.

SUMMARY

Forty necropsied cases of human asbestosis have been analyzed and certain findings related to uncleared questions are here presented.

In this series occurs evidence that the disease does not progress beyond a limited time after exposure to asbestos dust ceases, although the fibrosis caused persists and ages into dense scar tissue. In minor grades of the disease, there is little to indicate any recognizable influence. Characteristically some other unrelated condition caused the fatal disease. In practically all such cases the state of asbestosis was undiagnosed until disclosed at necropsy. This was likewise true in most of those of medium grade lung damage. Only in advanced form was asbestosis a conspicuous state and in only a part of those of that grade was it a major event or the sole factor in the fatal disability.

Asbestosis bodies remain deposited in the lung indefinitely, at least as long as twenty-seven years. In old deposits they show some evidence of change. Smaller forms do occur in peribronchial lymph nodes.

Pleural involvement as a part of the disease is not constant nor essential. It is indicated as of secondary occurrence.

Local fibrous nodular lesions comparable to those characteristic of silicosis occurred in such prominence as to question whether they may not also be produced by asbestos.

Carcinoma of the lung was also of such prominence as to require continued consideration as possibly inducible in a susceptible subject by severe asbestosis until disproven by further investigation.

Although tuberculosis of the lungs occurred with more frequency than in the general necropsy series, careful analysis of pertinent evidence does not add much weight to the idea of relationship, while some evidence occurred that improvement of tuberculosis may proceed in the face of advancing asbestosis in at least one case.

RESUMEN

El carcinoma del pulmón también ocurrió con tal prominencia que no se debe abandonar la posibilidad de que sea producible en un sujeto sensible por la asbestosis grave, a menos de que sea refutado esto por investigaciones ulteriores

Aunque la tuberculosis pulmonar ocurrió con más frecuencia que en la serie general de autopsias, el análisis cuidadoso de los datos pertinentes no apoya la idea de que exista alguna relación entre estas dos enfermedades, mientras que, por lo menos en un caso, hubo datos que indicaron que la tuberculosis puede seguir mejorando aun cuando la asbestosis continúa avanzando

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D i s c u s s i o n

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Prior to 1930 there was almost no mention in American medical literature of any specific disease due to asbestos. In the British and French literature, authors recorded high frequency of chest

symptoms among asbestos workers and speculated on the relation of symptoms to the inhalation of asbestos or of silica or of iron or to other conditions associated with asbestos work. There were reports of a high tuberculosis morbidity among those exposed, and general high mortality. Some authors gave fair descriptions of the pathology or of the clinical picture of what we now call asbestosis but correlation of the pathology, roentgen appearance and the essential factor in etiology was lacking. There was consensus, however, that somehow asbestos work was harmful. The international encyclopedia on industrial diseases, entitled "Health and Occupation," published in 1930, deplors the lack of more accurate and detailed data on the asbestos hazard, and goes on to say that the increasing utilization of asbestos urgently calls for study of the condition.

In 1930, Lynch and Smith published the first necropsy protocol together with the detailed occupational history which left no doubt that the disease is a lung fibrosis and is directly due to the inhalation of the asbestos in the dust. R. S. Mills, in the same year, and later, Lanza, Gardner, McConnell, Pendergrass, Shull, Sparks, Stone and others made important contributions. In the seventeen years since that confession of confusion in the encyclopedia and Lynch's pioneer publication, American medicine has progressed

heals under the most unfavorable conditions of the infected organ. That tuberculosis may heal in the face of asbestosis, therefore, should not add any weight to *either* side in evaluating the effect of asbestosis on tuberculosis.

Dr. Lynch may not be conscious of a sermon to the clinician contained in his post-mortem reports. He said that in most of the well-developed, though not in advanced cases, the history of asbestos exposure was traced *after* necropsy diagnosis. To me, that means that the clinicians neglected the occupational histories of their patients, probably because there was another serious disease present. That the diagnosis was made post-mortem suggests there were not enough routine chest films made of these workers when they were well and certainly not sufficient chest examination when they became ill. We should take to heart this failure to recognize the occupational disease during life. Many new substances were introduced in industry in the last decade, new compounds known only to the chemist today will be used in industry tomorrow. Some of these substances may produce chest symptoms. The *clinician*, practising in the locality of the industry, and not the pathologist should be the first to clearly state that an industrial process is a health hazard. The *clinician* must be the first to know, what is equally important from a health viewpoint, that some suspected industrial process *is not* a health hazard. Let us reflect on the significance of the fact that twenty years ago hardly one of us would have suspected that the lung symptoms presented by one of our patients working on refrigerator insulation were directly due to asbestos. Perhaps today some of us are missing the etiologic factor in cases that now are under our observation because we neglect the occupational history. Dr. Lynch's studies on the pathology would be of only passing interest if he had not combined them with investigations into the occupational history in each individual case. It is the correlation which makes them a major contribution to medicine.

There are other conclusions of Dr. Lynch's applicable to problems of the clinician. Dr. Lynch finds indications that when exposure ends the disease develops but little further. The prognosis, therefore, is definite, and that must be a comfort to the victim that makes it easier to get him readjusted to a new occupation and makes Workmen's Compensation adjudication much simpler. Dr. Lynch is speaking, of course, of the fibrosis, his statement must not be applied to the secondary cardiac embarrassment once that has begun. That may progress even without exposure. If I misinterpret Dr. Lynch's conclusion I trust he will emphatically correct me. The pathologic finding that fibrosis persists and ages into scar tissue explains the outstanding physical sign of the disease,

limitation of chest expansion and also means that no recession of symptoms or signs directly related to the fibrosis is to be expected

Another finding is that length of exposure and severity of the disease are correlated. This sounds self-evident but in silicosis we cannot make that statement. This characteristic should enable us to concentrate and strengthen asbestosis case-finding among those workers who need it most, i.e., those with long exposure, and to be alert when examining a patient who declares "Oh no, that dust does not bother me, I'm used to it, worked there without trouble for twenty years." Furthermore, this correlation of exposure-time with severity enables a workmen's compensation board to equitably allocate liability when two or more employees with asbestos hazards are involved in the same case. Then, too, Dr. Lynch's conclusions mean that when we have negative medical findings on a patient exposed for only a few months we can reassure him with confidence on the absence of dust disease.

As if to balance these conclusions which make our jobs easier, the newer observations indicating that nodular fibrosis may occur in asbestosis makes matters more complicated. Now, knowing that nodulation occurs in asbestosis not only the pathologic but also the roentgenologic distinction from silicosis becomes more blurred. We must be more cautious or perhaps, give up trying to reason from a firm or a pathologic finding as to the type of dust exposure.

This has been an informative presentation. It necessarily is an unusual privilege to be first to hear reports of pioneer investigation from men whose publications have their place in the history of diseases of the chest. I want to express my thanks to Dr. Lynch for that privilege today.

D I S C U S S I O N

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I wish to compliment Dr. Lynch on the contribution he has made to our knowledge of asbestosis.

Pulmonary asbestosis differs from silicosis by size, etc., of the particles inhaled and by chemical composition. Asbestosis is caused by an alkali which is magnesium silicate, along with calcium and iron. In silicosis the offending dust particle is silicon dioxide. In asbestosis the shape of the particle causes them to be arrested more often in the bronchioles and the alveoli and they are not so

readily transported into the lymphatic system. Due to these facts pulmonary asbestosis gives a different pathological and radiological picture than that of silicosis.

The sputum in silicosis reveals no diagnostic characteristic while in asbestosis characteristic asbestosis bodies are found. Earlier in the course of the disease the x-ray findings in asbestosis are similar to those of silicosis, however, as the disease advances asbestosis gives the appearance of a ground glass opacity with involvement of the costophrenic angles while in silicosis the later stages show increased nodulation without the ground glass appearance and the costophrenic angles clear.

Velocity of Ether Absorption from Visceral Pleura Pleura-to-Tongue Circulation Time*

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The visceral pleura and its ability to absorb matter either liquid or particulate has been demonstrated.¹ These studies dealt with the site and character of absorption, rather than with the readiness with which the injected material is removed.² In the present communication are certain observations on the velocity with which ether in sterile isotonic solution of sodium chloride placed on the visceral pleura is absorbed and the time required for the same to be tasted. The required time is named the pleura to tongue circulation time, knowing that readily diffusible substances are absorbed directly into the blood vessels.³

Material and Method of Study Eighteen patients receiving artificial pneumothorax for pulmonary tuberculosis were selected for this study. In all, excepting patients No. 9 and 18, the disease was quiescent. With care for asepsis, 0.3 cc of ether, and 0.3 cc of isotonic solution of sodium chloride were drawn into a 2 cc syringe. After shaking the contents gently five or six times, the solution was dropped directly upon the surface of the visceral pleura through a 20 gauge needle, not taking more than two seconds to do so. The needle for this procedure was inserted in the fourth intercostal space at the midaxillary region. The point of the needle was held at a slight angle to the projected spot of the pleural surface. Care was taken to prevent the ether from coming in contact with the parietal pleura because when this occurred the patient felt pain in the thoracic wall. Furthermore, the isotonic solution of sodium chloride was intended to be absorbed by the intrapulmonary vessels and not by the vessels of the thoracic wall.

In all patients, the velocity of absorption of the right lung was determined, and in the rest that of the left lung. The interval between the instillation of the solution and the tasting of ether by the patient is timed and regarded as the velocity of ether absorption or the pleura-to-tongue circulation time.

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Findings and Discussion

The procedure in this study was entirely harmless in all

The velocity of the absorption of ether varied considerably in the series studied. The most rapid pleura-to-tongue time was two seconds in two patients, but in the majority, it varied between forty to seventy seconds (Fig. 1). It seems that the variation was

FIGURE 1

Case No	Age	Sex	Duration of Pneumothorax	Side of Pneumothorax	Pleura to Tongue Cir- culation Time In Seconds
1	28	F	5 years	Right	10
2	29	F	2½ "	"	25
3	32	F	5 "	"	30
4	26	F	1 "	"	40
5	25	M	4½ "	"	45
6	36	M	4 "	"	45
7	43	M	4 "	"	55
8	45	M	6½ "	"	60
9	20	M	3 months	"	60
10	34	F	2½ years	Left	2
11	33	M	3 "	"	2
12	19	F	2 "	"	40
13	39	M	3 '	"	45
14	39	F	3½ "	"	60
15	27	M	6	'	60
16	27	M	3	"	60
17	26	M	3½ '	'	70
18	23	M	3 '	'	70

primarily due to the different degrees of pleural thickening in these patients. Pleural thickening was a constant occurrence in artificial pneumothorax both in animals⁴ and men.⁵ It would seem that the thicker the pleura, the slower the absorption would be. Therefore, in those with a normal pleura and satisfactory pulmonary circulation, the velocity of the absorption of ether may be faster. The sex, age, duration of the pneumothorax, intra-pleural pressure, and effusion as such do not appear to be the determining factors in the velocity of the absorption.

The most rapid absorption occurred in two patients (No. 10 and

11) with left-sided pneumothorax It was suggested that the absorption of readily diffusible or particulate matter from the left pleural cavity may be faster than that from the right on account of the stronger impact of the heart action upon the left lung⁶ The comparative infrequency of left sided hydrothorax in congestive heart failure may be in part due to the same factor Additional studies on those patients without pleural thickening are necessary to be certain of this question

Four patients smelled the ether about one or two seconds before they tasted it This suggests that the ether, after it is absorbed through the pleura, enters both the pulmonary blood vessels and bronchial system In the presence of a bronchopleural fistula, large enough to be clinically significant, the patients smelled the ether within 2 seconds after it was dropped into the pleural cavity It would be of interest to determine the velocity of absorption in health as well as in congestive heart failure, consolidation, atelectasis, pulmonary hypertension, and other allied affections

SUMMARY

When 0.3 cc of ether and 0.3 cc of isotonic solution of sodium chloride were dropped upon the visceral pleura, the ether was tasted in forty to seventy seconds by thirteen of the eighteen patients studied In two patients, with the least degree of pleural thickening, the ether was tasted in two seconds One tasted it in ten seconds, one in twenty-five seconds, and one in thirty seconds The thickness of the pleura was considered a major determining factor in the velocity of the ether absorption The procedure was harmless in all

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Parasitic Infections of the Lung*

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A great variety of disease-producing organisms cause significant pathologic changes in the human respiratory tract. Strictly speaking all of these agents are parasitic in that they invade the host's tissues, live at his expense and induce more or less characteristic reactions. The roles of various bacteria are well understood. In recent years attention has been increasingly directed to certain pathogenic fungi which have been identified as the etiologic agents of pulmonary disease. These latter conditions are now reasonably well known. Much less well-known, however, are the lesions and the clinical syndromes produced by invasion of the respiratory system by certain protozoan and metazoan parasites. This is not unexpected since certain of these organisms are restricted to the tropics and the subtropics, others, because of their requirements for specific intermediate hosts not indigenous to the North American continent, are rarely encountered in conventional practice in the United States, and still others not uncommon among rural populations, especially in the south, are not endemic in other areas where climatic factors or the highly developed sanitation of urban centers interrupt the cycle of transmission.

requirements of the parasite. This form of malaria, however, is widely disseminated throughout the tropics and infected individuals travelling by air may easily reach communities in the temperate zone within the limits of the incubation period. Fortunately this highly dangerous disease can be cured by specific therapy and does not exhibit the repeated relapses characteristic of the other types of malaria. For this reason it is not seen among veterans.

The pathogenic potential of *Plasmodium falciparum* depends upon certain particular characteristics of the host-parasite relationships which are not shared by the other species of malaria plasmodia. The asexual forms of this parasite invade the red blood cells irrespective of age. Consequently there is no limiting factor to prevent progressively increasing parasitemia. They likewise induce physical changes in the infected erythrocytes which contribute importantly to the pathology of the infection. The cells agglutinate, forming thrombi and emboli. They likewise adhere to capillary endothelium. These effects produce capillary obstruction, severe ischemia in many tissues of the body, determining the clinical syndrome. In the lungs this process may produce a true malarial pneumonitis with bloody sputum containing many parasitized red blood cells, or an interstitial type of reaction. In the course of a single year some 37 per cent of all malaria patients admitted to a military hospital in Panama presented either a malarial pneumonitis or a complicating "viral" or bacterial infection of the lungs.^{1,2}

The *Endameba histolytica* has a widespread and cosmopolitan distribution because of the resistance of the infective encapsulated stage to adverse factors of the environment. The incidence of amebiasis varies directly with the general level of sanitation, from an average of 9.8 per cent in the United States to 50 per cent or higher in certain areas of the tropics and sub-tropics. In contrast to the experience with malaria during the war this infection was a relatively unimportant cause of hospitalization of our service personnel. This may well prove a misleading observation, however, since the development of clinical disease is determined by many factors, important among which are strain variations of virulence.³ Furthermore, infection may remain latent for prolonged periods and then produce vague but important degrees of chronic ill health. This I am seeing frequently among veterans, many of whom give no antecedent history of dysentery or diarrhoea.

Although this parasite affects predominantly the proximal portion of the colon, serious disease of the lung may occur as a complication. The *Endameba histolytica* is a strict parasite invariably invading the host's tissues irrespective of the presence

or absence of clinical signs of infection. In the course of this invasion organisms not infrequently gain access to the venous systems and are transported to the liver or less commonly to the lung and other organs.

Next to the intestine or the liver, the lung is the organ most frequently invaded. Pulmonary involvement may be secondary to an hepatic abscess perforating through the diaphragm or it may occur independently. In the latter instance the amebae reach the lung parenchyma through the hepatic vein and the pulmonary arteries. Irrespective of the route of invasion the pathologic changes are similar. There is extensive destruction of tissue spreading centrifugally. Extensive pleural effusion develops as the process approaches the periphery of the lung. Ultimately the abscess may rupture into the pleural cavity or open into a bronchus. In the latter instance evacuation of the contents produces the characteristic anchovy-sauce-like sputum.

Pulmonary amebiasis is accompanied by the signs of severe infection and toxemia. Although the infecting organisms are easily eliminated by emetine hydrochloride, extensive destruction of the parenchyma or invasion of the pleura may lead to prolonged illness and may require radical surgical intervention after effective amebicidal therapy.

Members of two phyla of the metazoa, or multicellular organisms, may produce lesions in the respiratory system of man. One of these, the Nematelminthes or round worms, includes four members capable of producing pulmonary disease. These are the hookworm, the large round worm *Ascaris lumbricoides*, *Strongyloides stercoralis*, and *Trichinella spiralis*. All of these are endemic in the United States. The first three are widely prevalent throughout the tropics and the subtropics, and are not uncommon infections in returned service personnel. Severe lesions of the respiratory system, however, are relatively uncommon and are generally acute and transitory.

The pathologic changes produced by hookworm infection occur only in the very early stages in the course of the migration of the infective filariform larvae from their portal of entry through exposed skin areas. These larvae gain access to the subcutaneous vessels and are transported in the blood stream to the lungs where they leave the capillaries actively penetrating the alveolar walls. After reaching the alveoli they migrate up the bronchial tree to the pharynx and thence down the oesophagus to the upper small intestine where they develop to maturity.

The migration of the larvae from the pulmonary capillaries into the alveoli produces minute hemorrhagic lesions in the parenchyma. In heavy infections these may be numerous and may be

accompanied by cellular infiltration. There may be extravasation of blood into the alveoli, bronchial irritation and productive cough with bloody or blood tinged sputum. In general, however, the pulmonary reaction is much less severe than that accompanying ascariasis or strongyloidiasis.⁵ Furthermore, since the lesions are produced only by the migrating larvae they are transitory in nature and without sequelae.

Ascaris lumbricoides, the large round worm, on the other hand, may cause serious acute disease of the lungs. Ingested embryonated ova release the contained larvae in the intestinal tract. These penetrate the intestinal mucosa, enter the vascular bed and are carried to the lungs in the blood stream, whence they migrate up the respiratory tract ultimately to reach the small intestine where they complete their development and take up their adult habitat.

Since the larvae are considerably larger than the diameter of the pulmonary capillaries occlusion and immediate damage is produced, which is augmented as they penetrate into the alveolar spaces. There are petechial hemorrhages, extravasation of blood into the parenchyma and into the alveoli, leucocytic infiltration with many eosinophiles and desquamation of the pulmonary epithelium. After reaching the lung the larvae undergo two molts in the course of which they increase from a length of about 0.2 mm to 1.5 mm within approximately ten days. When these developmental changes are completed they resume their migration to their final habitat in the intestine. The passage of the larvae from the capillary bed through the lungs is accompanied by pneumonitis, the intensity of which is determined by the intensity of the infection. The sputum is frequently bloody or blood-tinged and the larval worms may be demonstrated in it.⁶ Clinically there are the usual phenomena of intoxication accompanied by leucocytosis with eosinophilia. The indications of pulmonary pathology vary from those of a patchy bronchitis to confluent lobular or even a lobar type of pneumonia. The severe lesions are more usual in children since they are commonly exposed to more intense infections than are adults. Although death may occur in these severe cases in the acute stage, there is usually no demonstrable residual pathology in the lung after the period of larvae migration is completed.

The round worm *Strongyloides stercoralis* may cause severe acute and chronic disease of the lung. Infection is acquired, as is the case with hookworm, by contact of the unprotected skin with soil containing the filariform larvae of the parasite. These gain access to the subcutaneous venule and are carried to the lung whence they migrate through the air passages to the pharynx ultimately to reach the colon their normal habitat.

The migration from the capillaries into the pulmonary alveoli is accompanied by hemorrhage, cellular infiltration, and signs and symptoms of bronchitis or pneumonitis which may be quite severe. In some instances, however, migration is incomplete and certain precocious individuals penetrate the bronchial or tracheal epithelium where they remain and develop to maturity. If both male and female worms are present, reproduction occurs with oviposition in the pulmonary tissues, release of rhabditiform larvae which may be recovered from the sputum, and the development of chronic bronchial disease, pulmonary strongyloidiasis. The larvae have been found in both pleural and pericardial effusions. This disease has not been completely studied. It is probable, however, that it occurs only in severe massive infections.

Recommended treatment consists of the intravenous administration of medicinal gentian violet in individual doses of 25 cc of an 0.5 per cent aqueous solution.

intermediate hosts It occurs in certain parts of Africa, the Orient, and some areas in South America

Its life cycle is complicated The early developmental stages are carried through in certain specific snails following which a further developmental period in crayfish and fresh-water crabs is required for maturation of the forms infective to man Infection occurs when these crustacea are eaten raw After ingestion the larval parasites pass through the wall of the intestine into the peritoneal cavity, migrate through the diaphragm and penetrate the lung parenchyma, commonly localizing in the immediate vicinity of small bronchioles

A surrounding inflammatory reaction occurs with parenchymal necrosis and the formation of an inclosing fibrous capsule The resulting cysts containing the adult worms and bloody or purulent fluid in which many ova are present, commonly communicate with a bronchiole or bronchus The parenchyma about the cysts is atelectatic and at times hemorrhagic In long-standing infections large areas of atelectasis and at times abscess formation occur distal to the lesion In other instances the ova discharged into the bronchi are aspirated to other areas of the lung where they lodge and act as foreign bodies inducing the formation of pseudotubercles

The clinical picture of paragonimiasis is predominantly that of a chronic bronchitis or bronchiectasis with morning cough productive of tenacious or brownish sputum in which ova of the parasite may be demonstrated Hemoptysis is not infrequent, and when cysts are present in close proximity to the pleura there may be pleural pain or pleural effusion Treatment is unsatisfactory

The blood flukes or schistosomes commonly inhabit the veins of the abdominal cavity in the distal radicles of which the ova are deposited The pathologic changes produced by these infections are primarily due to the irritative effect of the ova and generally are most pronounced in the intestinal tract, the urinary bladder, the liver and the spleen

These parasites likewise require particular species of snails as their intermediate hosts in which the stage infective for man develops Suitable hosts are not known on the North American continent The geographical distribution of *Schistosoma hematobium* is largely restricted to Africa, *Schistosoma mansoni* is endemic in Africa, parts of South America and certain islands in the Caribbean including Porto Rico, *Schistosoma japonicum* is found only in the orient including the Philippines and particularly the island of Leyte where numbers of our troops were infected in combat Attention has been attracted particularly to *Schistosoma japonicum* infections because of the occurrence of some 1,600

recognized cases among our troops in the campaign on Leyte,⁷ and because these infections if not cured carry an ominous prognosis

The infective forms of the schistosomes leave the tissues of the intermediate snail host for a brief free-living existence in fresh water during which they must reach their definitive host to survive. These cercariae when they come into contact with exposed skin penetrate into the peripheral venules, are carried by the blood-stream to the intra-abdominal veins where development is completed and oviposition occurs.

The pulmonary lesions produced by the schistosomes do not differ between the three species. It has been suggested that the passage of the immature parasites through the pulmonary vascular bed may give rise to a clinical picture resembling lobular pneumonia. The more important lesions, however, are produced by ova which are carried by the venous stream from the site of oviposition to lodge in the vessels of the lung. This induces an acute granulomatous lesion surrounding the ovum with cellular infiltration and necrosis. The adjoining parenchyma is involved by a fibrinous exudate filling the alveoli in which there are numerous cellular elements principally macrophages and eosinophiles.⁸ Abscess formation may occur. As the lesion becomes chronic the exudate disappears, the degenerated ovum is inclosed in a dense fibrous capsule and deposition of calcium occurs. In instances when there is extensive involvement of the lung x-ray examination during the acute stage may yield the typical radiologic picture of miliary tuberculosis.

The pathologic process in the lung naturally cannot be affected by therapy. Treatment by tartar emetic or fuoadin kills the adult worms thus preventing progressive increase in the number of lesions.

Two of the cestodes may cause serious pulmonary disease. *Taenia solium* the "measly-pork" tapeworm, and the dog tapeworm *Echinococcus granulosus*. Both of these parasites are widely distributed. The pathologic changes which the former induce are produced by the larval stages of the parasite which undergo altered or abnormal development in man, an accidental and abnormal intermediate host.

The pork tapeworm has a cosmopolitan distribution and is found throughout the world wherever raw or incompletely cooked pork is consumed. It is rare on the North American continent. Man is the definitive host, the host of the adult worm, and the hog is the usual intermediate host in which the infective larval forms develop. The adult resident in the intestinal tract does not of itself produce pathologic changes or significant clinical phenomena. In the normal life cycle the infective ova are passed

in the feces, reach the normal intermediate, the hog, and larval development occurs in the musculature of this animal

Man may become an abnormal intermediate host under two conditions. An individual harboring the adult worm and passing infective ova in the feces may accidentally ingest ova as the result of poor personal hygiene. Or reverse peristalsis may carry gravid proglottids into the stomach with consequent release of the infective onchospheres. In either event the liberated organisms penetrate the walls of the digestive tract and are distributed throughout the body in the blood and lymph streams. The larvae localize predominantly in the subcutaneous tissues, the brain, and not uncommonly in other organs including the lung. In these sites larval development occurs with the formation of the cystic body *Cysticercus cellulosae* which give rise to the clinical disease cysticercosis.

The larvae at first cause an acute inflammatory reaction with tissue necrosis, infiltration with neutrophils, eosinophiles and lymphocytes and stimulation of fibroblast production. Subsequently the parasite becomes inclosed within a fibrous capsule, or necrosis followed by caseation and calcification may occur. It is probable that the larval forms live for at least three years and that another three years elapses before the cysts which measure from 0.5 cm to 1.0 cm in diameter become calcified.

During the stage of invasion in the presence of a heavy infection the clinical picture will be that of acute toxemia and pressure symptoms if vital structures are involved. The late stages are characterized by foreign body and pressure phenomena.

The dog tapeworm *Echinococcus granulosus* likewise has a very wide geographical distribution but is decidedly rare in the United States. It is said that only twenty-five cases indigenous to this country have been reported.⁴ It is common, however, in many areas occupied by our troops during the war and the notorious affinity between the average American soldier and any dog makes it highly probable that, in the future, cases will be found among veterans.

The adult worm inhabits the intestine of its carrier host and ova passed in the feces are infective. Such ova reach the intestinal tract of man by hands, food, drink or containers contaminated with feces of infected dogs. The contained onchospheres are released in the duodenum, penetrate the intestinal wall and are transported to their final resting place by the blood stream where the surviving parasites develop into hydatid cysts. The majority of the larvae are filtered out in the liver and the lungs.

The initial development of the larva is relatively rapid, and at the end of five months it is about 1 cm in diameter. Thereafter

growth is slow and it may be twenty or more years before pressure effects give rise to clinical phenomena. Two main types of hydatid cyst occur, the unilocular localized type and the alveolar type which is malignant and metastasizing.

The alveolar cyst wall consists of an inner germinal layer from which brood capsules containing numerous scolices, and daughter cysts are produced, and an outer laminated elastic layer, the whole inclosed in a connective tissue capsule. The alveolar type of hydatid usually develops as the result of trauma or intracystic pressure causing evagination of the germinal layer through the cyst wall and exogenous budding into the surrounding tissues. When this occurs peripheral extension results with infiltration and metastatic spread as viable scolices penetrate blood vessels and lymphatics. This latter type of disease is incurable in the great majority of instances.

Hydatid cyst of the lung is rarely recognized until it has reached relatively large size and is producing significant pressure effects. The clinical picture in such instances is usually not that of acute disease. However spontaneous rupture may occur into the pleural, the pericardial or the peritoneal cavities causing a violent and sometimes fatal reaction. In other instances the cyst may open into a bronchus and the diagnosis be established by the demonstration of "hydatid sand"—brood capsules and scolices or hooklets in the sputum.

sufficient frequency to merit consideration. It is probable that such conditions will be recognized more frequently in the future since several million men and women have had overseas service in areas of the world where some of the more important parasites are heavily endemic. The increasing interest of American business in foreign countries implies a constant flow of personnel to these regions, and foreigners are coming to the United States in increasing numbers from many parts of the world. These individuals therefore constitute a very large number of persons who potentially at least may have been exposed to infections which are not endemic in this country.

Investigation of clinical problems in such a group necessitates the application of geographical medicine—the interpretation of clinical data in the light of the travels of the particular patient and the geographic distribution of particular parasites. The infections, therefore, may be grouped from this point of view. Amebiasis, malaria, ascariasis, strongyloidiasis and cysticercosis may be acquired in the United States as well as in many other parts of the world. On the other hand paragonimiasis and schistosomiasis cannot be acquired on the North American continent, and endemic hydatid disease is so rare in this area as to be virtually nonexistent.

In the consideration of future medical problems among veterans it is of the utmost importance that these implications of geographical medicine be given due consideration. It is equally important to recognize the fact that there may be a prolonged latent period, in some instances years in duration, between infection and the development of the resultant clinical syndrome.

RESUMEN

Aunque las enfermedades de las vías respiratorias causadas por infecciones con parásitos protozoarios o metazoarios no son comunes en la práctica convencional de la medicina, sí se las encuentra con suficiente frecuencia para que merezcan consideración. Es probable que se reconozcan estas condiciones más frecuentemente en el futuro, ya que varios millones de hombres y mujeres han prestado servicios militares en zonas mundiales donde algunos de los parásitos más importantes son sumamente endémicos. El interés creciente del comercio americano en países extranjeros ha causado una corriente constante de viajeros a esas regiones y los extranjeros de muchas partes del mundo llegan a los Estados Unidos en números crecientes. Por consiguiente, estos individuos constituyen un número muy grande de personas que, por lo menos potencialmente, pueden haber estado expuestos a infecciones que no son endémicas en este país.

La investigación de problemas clínicos en tal grupo necesita la aplicación de la medicina geográfica—la interpretación de los datos clínicos a la luz de los viajes del paciente individual y de la distribución geográfica de los parásitos en cuestión. Por consiguiente, pueden ser agrupadas las infecciones desde este punto de vista. La amibiasis, la malaria, la ascaridiosis, la estrongiloidosis y la cisticercosis pueden adquirirse en los Estados Unidos lo mismo que en muchas otras partes del mundo. Por el contrario, la paragonimiasis y la esquistosomiasis no pueden adquirirse en el continente norteamericano y la enfermedad hidática endémica es tan rara en esta zona que casi que no existe.

En el futuro cuando se consideren los problemas médicos de los veteranos es de suma importancia que se le preste la debida atención a estas complicaciones de la medicina geográfica. Es de igual importancia que se reconozca el hecho de que puede ocurrir un período latente prolongado, que dura años en algunos casos, entre la infección y el desarrollo del síndrome clínico resultante.

I cannot remember seeing any proved instance but I am sure that they occur more frequently than we think. Certainly the malarial parasites must get into the vascular bed of the lung and occasionally set up an inflammatory process there and the same thing can be said for *E. histolytica*. In view of this fact, I would recommend that a routine stool examination be done on every case of lung infection.

The Utilization of Collapse Therapy*

The sub-committee on Non-Surgical Collapse Therapy in May 1948 embarked on a special study to determine the kind of therapy that is being used in the commonly seen, uncomplicated cases of pulmonary tuberculosis

The members of this sub-committee are as follows

Benson Bloom, M D , Tucson, Arizona
W LeRoy Dunn, M.D , Washington, D C
Alfred Goldman, M D , St Louis Missouri
James J Hennessey, M D , Hartford, Connecticut
John S Packard, M D , Allenwood, Pennsylvania
Giles Wolverton, M D , Dayton, Ohio
Harold G Trimble, M D Oakland, California, *Chairman*

Your committee selected ten cases of pulmonary tuberculosis representing problems seen regularly by any consultant in diseases of the chest There are no trick cases or unusual problems in this group The plan was to get a cross-section of opinion as of June 1948 regarding the treatment of these relatively common types of pulmonary tuberculosis These opinions were then tabulated for the following report

A brief case history and a questionnaire (reproduced in full for Case I, see below) and a 4 x 5 reproduction of the first chest x-ray, for each of the ten cases, was sent to each of the doctors participating

Neither the chairman nor any of the committee members were responsible for filling out any of the questionnaires nor advising on the therapy in any individual case The committee members were asked to select the names of men who by experience and position were best qualified to discuss collapse therapy in their respective areas As the committee had been appointed with geographical distribution in mind this was easily possible The committee members were further asked to select men who were in the actual clinical practice of diseases of the chest, not necessarily public health officers or hospital administrators or x-ray men or pathologists The illustration will show the geographic distribution of the men participating

There was remarkable response on the part of the physicians selected Of the fifty-nine sets of films and questionnaires sent out, fifty-seven replies had been received at the time this tabulation was completed The following study is based on these fifty-

*A study by the Sub-Committee on Non-Surgical Collapse Therapy of the Committee on Management and Treatment of Diseases of the Chest Presented to the Board of Regents, American College of Chest Physicians at the 14th Annual Meeting, Chicago, Illinois, June 20, 1948

seven replies You will note a slight discrepancy in the figures from case to case, as not all of the men answered each question We are giving you the results of their answers exactly as received

The following participated in the study

Anderson, Russell, M.D., Erie, Pennsylvania
 Andosca John B., M.D., Mattapan, Massachusetts
 Avery, Roscoe, M.D., Barre, Vermont
 Aven, Carl C., M.D., Atlanta, Georgia
 Bloch, Robert G., M.D., Chicago, Illinois
 Bonner M. D., M.D., Jamestown, North Carolina
 Brasher, Charles, M.D., Mt Vernon Missouri
 Brock, Benjamin, M.D., Downey, Illinois
 Brown, Cabot M.D., San Francisco, California
 Brown R. Kyle, M.D., Greenville, South Carolina
 Cake Charles, M.D., Washington, D. C.
 Carman Frank, M.D., Dallas, Texas
 Chernyk, Maurice, M.D., Denver, Colorado
 Childerhose, Ross K., M.D., Harrisburg, Pennsylvania
 Cole Dean B., M.D., Richmond, Virginia
 Castellano Martin, M.D., Newark, New Jersey
 Crellin J. A., M.D., Philadelphia, Pennsylvania
 Crimm Paul D., M.D., Evansville, Indiana
 Flance I. J., M.D., St. Louis, Missouri
 Fleishman, Max, M.D., Omaha, Nebraska
 Francis, Byron, M.D., Seattle, Washington
 Friedman Bernard, M.D., St. Louis, Missouri
 Glenn Elmer, M.D., Springfield, Missouri
 Greco, Edward A., M.D., Portland, Maine
 Greer, Alvis E., M.D., Houston, Texas
 Hayes, E. W., M.D., Monrovia, California
 Head, Jerome R., M.D., Chicago, Illinois
 Hetherington L. H., M.D., Pittsburgh, Pennsylvania
 Hodl, E. R., M.D., Allenwood, Pennsylvania
 Hudson William A., M.D., Detroit, Michigan
 Jacobs, Sydney, M.D., New Orleans, Louisiana
 Joannides Minas, M.D., Chicago, Illinois
 Kelley, Julius G., M.D., Pocasset, Massachusetts
 Kerr, Robert B., M.D., Manchester, New Hampshire
 McKay, Donald R., M.D., Buffalo, New York
 Mark Louis, M.D., Columbus, Ohio
 Murphy, Paul, M.D., St. Louis, Missouri



Geographical distribution of physicians participating in survey—57 men representing 32 states answered queries

Myers, Jay Arthur, M D , Minneapolls, Minnesota
 Odell, James M , M D , The Dalles, Oregon
 Ornstein, George, M D , New York, New York
 Placak, Joseph C , M D , Cleveland, Ohio
 Quinn, Robert, M D , Santa Rosa, California
 Randolph, Howell, M D , Phoenix, Arizona
 Rest, Arthur, M D , Denver, Colorado
 Ringer, Paul H , M D , Asheville, North Carolina
 Rubin, Eli H , M D , New York, New York
 Salkin, David, M D , Hopemont, West Virginia
 Schaffle, Karl, M D , Asheville, North Carolina
 Skavlem, John H , M D , Cincinnati, Ohio
 Sokoloff, Martin, M D , Philadelphia, Pennsylvania
 Stafford, Frank B , M D , Charlottesville, Virginia
 Stygall, James H , M D , Indianapolis, Indiana
 Terrill, Frank, M D , Deer Lodge, Montana
 Tonolla, E Howard, M D , Baltimore, Maryland
 Turner, Paul A , M D , Louisville Kentucky
 Ulmar, David, M D , New York, New York
 Vest, Walter E , M D , Huntington, West Virginia
 Wilson, Redford M D , Tucson, Arizona
 Zambiarano U E , M D Wallum Lake, Rhode Island

Case Histories and Discussions

Case I Mr R V E This 18 year old white male was found to have a small lesion in his right upper lung field on routine chest x-ray during a Navy induction examination He feels perfectly well and has no symptoms Past and family history—non-contributory No known exposure to tuberculosis

Physical examination negative Intradermal tuberculin positive to 1:10000 O T Gastric lavage with guinea pig inoculation showed, at



Case I

A minimal right apical lesion in an 18 year old boy

autopsy, typical tuberculous lesions from which acid-fast bacilli were recovered

Chest x-ray shows a small mottled infiltration at periphery of the right lung field under first anterior interspace

- 1) Would you use collapse therapy in this patient?
- 2) If so, what kind?
- 3) When?
- 4) If collapse therapy is used,
 - a) How long would you continue it?
 - b) What would be your criteria for stopping it?
- 5) Is streptomycin indicated?
- 6) If so,
 - a) When?
 - b) What dose?
 - c) How long?
- 7) Remarks
 - a) How long would you keep this patient in bed?
 - (1) Before collapse therapy?
 - (2) After collapse therapy (if used)?
 - b) Other

Discussion The panel was about equally divided as to whether collapse therapy should be used or not, with 10 per cent more favoring no collapse therapy, that is, 25 to 31. The choice of collapse was between pneumothorax and phrenic, with pneumothorax being about three times as popular, 18 to 7. Of those favoring collapse, a great majority would begin immediately or within one month, with only 3 waiting for two or three months.

Five would keep this patient in bed following collapse for one month, one-half for six months or less, while 3 would continue bed rest for one year.

Pneumothorax would be maintained for 2 to 3 years, more favoring 3 years, 1 for one year and 1 for four years.

In the collapse group, streptomycin was advocated by only 1 (plus phrenic), and in all cases five times only.

In the "non-collapse" group, 4 would use ambulatory observation only. Six would use bed rest for 2 to 3 months. The majority would keep this patient in bed for 4 to 6 months or longer (3 for 7 to 12 months), and 8 gave no, or inadequate answer. Strange as it may seem it actually appears that, even leaving out the cases treated by ambulatory observation only, in this "non-collapse" group more would treat this patient with six months or less of bed rest than is true in the group who felt the lesion was serious enough for collapse therapy. This would seem to be a real difference of opinion as to the seriousness of such a lesion in an 18 year old boy. It does appear that those favoring conservative therapy were not so sure of their procedure as 8 (more than one-fourth) gave an inadequate or no answer to the question as to how long to

continue bed rest, as compared with only 2 such inadequate answers in the collapse group

Case II Mrs J S This 31 year old white married female developed an acute upper respiratory infection in January followed by productive cough and fever She had a hemoptysis and then visited her physician Past history revealed a negative chest x-ray three years previously Another film in May of the preceeding year was said to show a "spot" on her lung For the past three to four years, she had noted weakness and easy fatiguability, which she attributed to excessive menstrual flow

Chest x-ray shows a diffuse homogeneous density occupying the upper half of the right lung field containing a cavity Sputum was positive on smear for tubercle bacilli

Discussion A large majority favored collapse therapy—nearly 3 to 1 (41 to 16) The choice of collapse none chose a phrenic nerve operation, 30 chose right pneumothorax (1 with phrenic), 3 pneumoperitoneum, and 8 thoracoplasty Of those who chose pneumothorax 15, or one-half, would start immediately, 7 after one month, 4 after two months, 3 after three months, and 1 after four to six months Three of the 8 thoracoplasties would be immediately or within a month, 5 would wait two to six



Far advanced, tuberculous pneumonia in a 31 year old white woman

months, and all of these doctors would use streptomycin

The amount of bed rest expected, after collapse was begun, showed a marked variation, from one month to two years. More than half those answering this question felt that it should be continued for from seven to twelve months. There were 10 inadequate answers for this question. All of those advocating thoracoplasty felt that bed rest following surgery would not be necessary for longer than six months.

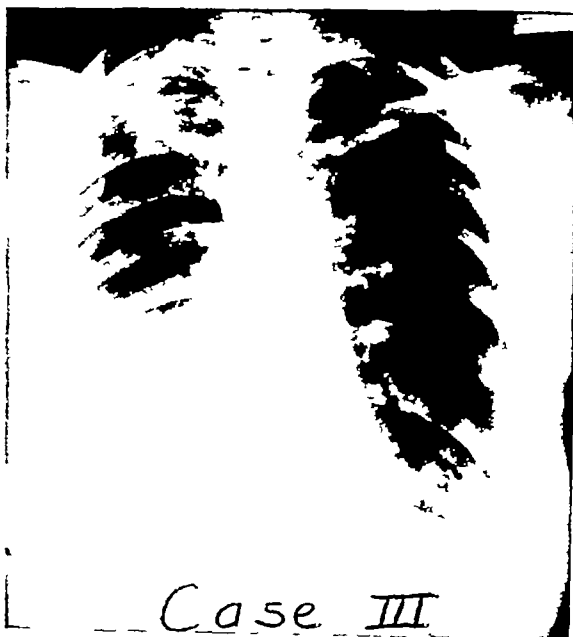
The time recommended to continue pneumothorax varied from two to five years, 12 of the 30 from four to five years, and 11 for three years, assuming an adequate collapse.

Streptomycin was advocated by 40 of the panel, 26 combining this with collapse and 18 of these (a little more than half) with pneumothorax. Nearly all of the non-collapse group (13 out of 16) would use streptomycin.

In the "non-collapse" group again, a large number (10 of 16), did not reply as to the amount of bed rest expected.

Case III Mrs. Z. L. This 43 year old white female, housewife and former nurse, noted the onset of easy fatigability and occasional pain in her right chest in May. These symptoms persisted and in September she began to have night sweats. On October 11th she developed acute pain in her right chest, dyspnea, chills and fever to 104°.

Chest x-ray revealed a homogeneous density in right pleural cavity.



Minimal pulmonary tuberculosis bilateral productive with pleural effusion on the right in a 43 year old white female

(pleural effusion) and infiltration at both apices—more marked on the right

The patient's mother died of tuberculosis in 1920—coresident

Clear yellow fluid was aspirated from the right pleural cavity Guinea pig inoculation of this fluid was negative Guinea pig inoculation of material obtained on gastric lavage was positive for tubercle bacilli

Discussion The panel here was about equally divided as to whether collapse therapy should be used as initial treatment or not In those who would use collapse the choice was between pneumothorax (21), thoracoplasty (4), pneumoperitoneum (2), and wax plombage (1) No phrenic operations were advised Three-fourths of the collapse therapy group favored converting to a right pneumothorax after aspiration The same large majority would begin the collapse therapy usually at once and always within a month, except for 3 of the 4 who would do thoracoplasties and the 1 who would want to do wax plombage, who would wait from two to six months

The seriousness of effusion complicating such a lesion is brought out by the fact that two-thirds would keep this patient in bed for over 7 months to a year (1 for two years) following collapse, although there were nine indefinite answers

The length of time pneumothorax should be maintained varied considerably, 4 favoring five years, 3, two years, the majority favoring three years

Streptomycin would be added to the collapse by 6 of the panel, 2 with pneumothorax All together 14 men favored using streptomycin, a fairly equal division between the collapse and non-collapse groups

In the non-collapse group, only one-half (compared with two-thirds of the other group) would keep this patient in bed for as long as seven to twelve months Again there were 14 answers that were inadequate in this group as compared with 9 in the collapse group, probably indicating less optimism regarding the results of their treatment

Certainly, again, there is brought out a difference of opinion as to the seriousness of the disease in this patient as shown above by the wide variations in treatment

Case IV Mr W N This 63 year old white male noted a productive cough, hoarseness and general run-down feeling in May He was seen by a physician in June with the above complaints plus pain in the region of the right kidney

Physical examination revealed rales at the right apex and right base posteriorly

Chest x-ray shows an area of infiltration at the periphery of the right upper lung field, a wedged shaped area of increased density at the right hilus and a small patchy infiltration at the right base Sputum positive for tubercle bacilli

Urological study negative right kidney History of left nephrectomy for hydronephrosis 10 years ago Otherwise past and family history essentially negative

Discussion The panel was about equally divided on the use of collapse therapy in this patient, 27 to 30 The choice of collapse was varied phrenic alone, 3, pneumothorax, 16 (a little more than half, and 1 of these with a phrenic), pneumoperitoneum 6 (4 with phrenics), thoracoplasty, 2 All but 2 would begin collapse therapy within a month

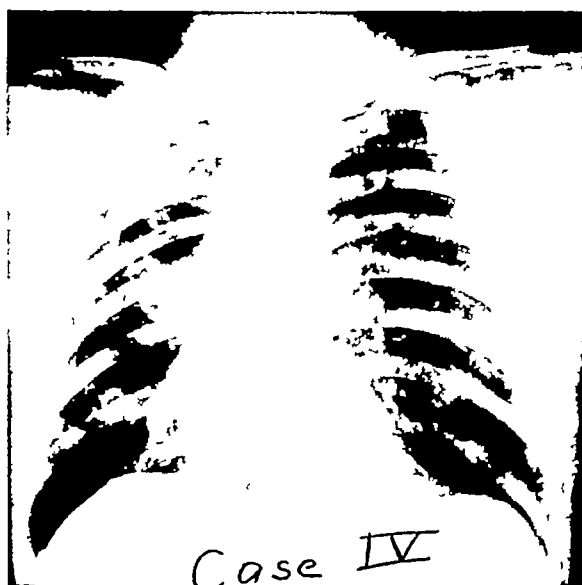
The length of bed rest recommended following collapse varied from one month to a year, without any really predominant period appearing in the answers

Only 2 would maintain pneumothorax for less than three years 3 for four years, 2 for five years to life and 3 of the answers were inadequate

Of the 28 of the panel who would use streptomycin, 10 would combine it with collapse therapy

In the non-collapse group of the panel, the large majority felt that bed rest would be necessary for seven months to two years, a much longer time than the collapse group, and there were 13 (to 4) inadequate answers This might indicate a feeling of rather poor prognosis as compared with using collapse therapy

Many of the panel felt in this case that there was question of tuberculosis of the larynx or tuberculous tracheobronchitis, which



Moderately advanced pulmonary tuberculosis unilateral,
no cavity acute in a 63 year old white male

influenced many to use stieptomycin and influenced others away from using collapse therapy, particularly pneumothorax

Case V Mr L T This 48 year old white male, school principal, had intermittent chest pain on the left since June one year ago The following April he developed considerable epigastric distress and lost 10 to 15 pounds over the next few months In October his chest x-ray revealed a diffuse fine mottling throughout the upper half of the right lung field Tuberculin test was positive and sputum was positive for tubercle bacilli Excellent general condition No other symptoms but a mild morning, slightly productive, cough

Discussion The panel here markedly favored collapse therapy, 47 to 10 Choice of collapse was between phrenic operation, 2, pneumothorax, 34, pneumoperitoneum, 4 (2 with, 2 without phrenic), thoracoplasty, 5, and wax plombage, 2 Nearly three-fourths favored pneumothorax Nearly three-fourths would start collapse immediately, 5 after one month, 3 after two months, 3 after three months, and 2 would wait from four to six months

The bed rest recommended after collapse varied from one month to two years, 19 recommended from one to three months, 8 from four to six months, and 3 for seven months to two years, a rather wide range of opinion



Moderately advanced pulmonary tuberculosis, unilateral
no cavity, fibrotic, in a 48 year old white male

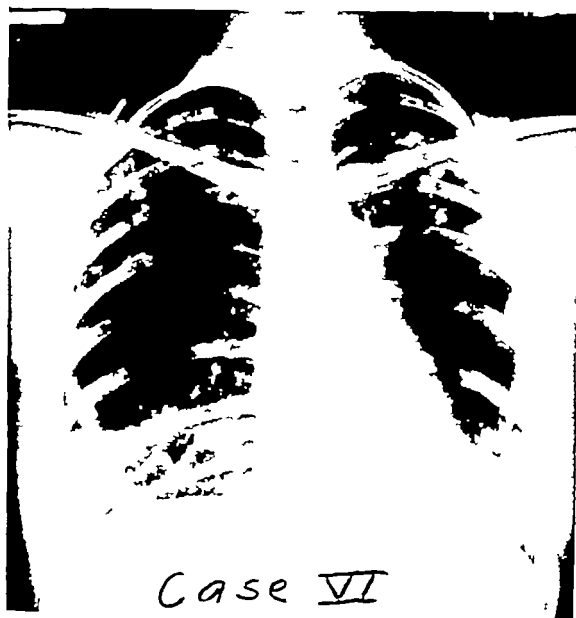
For the time the collapse should be continued, 10 recommended one to two years, 18, three years, 6, four years, and 1, five years. A wide variation, but the three year period was advised by more than all the other periods combined.

Streptomycin was only advocated 8 times in this case, 5 combined with collapse. Three of these were thoracoplasties, and 1 a wax plompage.

Of the 10 panel members who would not use collapse, one-half would expect to keep the patient in bed for six months or less. This represents a marked difference of opinion as to the seriousness of this lesion by a minority group of the panel who would not use collapse.

Case VI Mrs F S This 29 year old white married female has been underweight and easily fatigued since childhood. Seven years previously she had an upper respiratory infection and lost weight from 95 to 75 lbs. She was fluoroscoped at that time and told that she had tuberculosis but after six weeks she returned to work, no treatment. In June and again in September preceeding her present illness she had pleurisy on the left, was treated with bed rest and sulfa drugs, only until the pain and fever subsided. Now in February a third attack of pleurisy brought her to another physician. Her tuberculin test which was said to be negative several times before was now positive.

Chest x-ray at this time shows several scattered hard densities in both



Far advanced pulmonary tuberculosis, bilateral cavities acute with probable tuberculous tracheobronchitis in a 29 year old white female

upper lung fields In addition a soft mottled infiltration at the right apex with a 1 cm cavity in the right second anterior interspace There is a more diffuse mottled infiltration in the upper third of the left lung field with a 3 cm cavity at the level of the left second anterior rib Sputum positive for tubercle bacilli

Discussion A very large majority of the panel favored collapse of some sort, 51 to 6 The choice of collapse was phrenic operations, none, pneumothorax, 26 (left, right, or bilateral nearly equally divided with more than half of those favoring right pneumothorax having a left thoracoplasty in mind), and pneumoperitoneum, 25 (7 of these with a phrenic—side not specified) Note that no phrenic operations were advised alone Opinion was about equally divided between pneumoperitoneum and pneumothorax Many of the panel considered this type of patient an indication for initial pneumoperitoneum as compared with the other 5 cases previously reviewed

The majority of the panel felt that the patient should be at complete bed rest for from one to two years

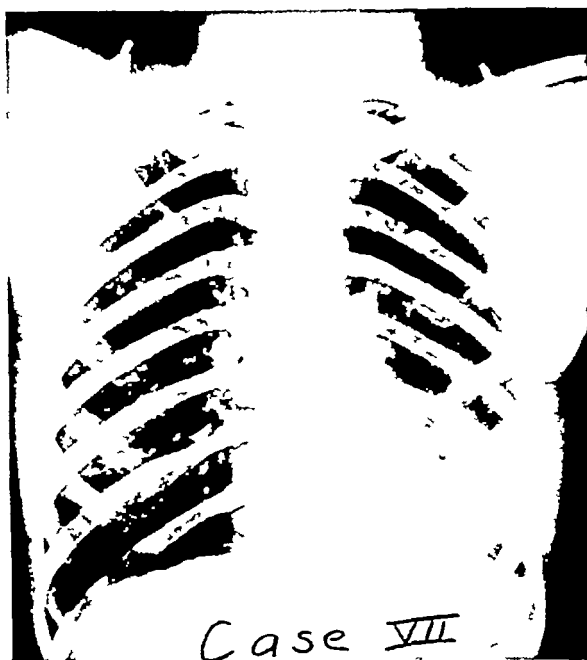
The time that pneumothorax collapse would be continued was about the same as in the previous cases, that is a three year average With pneumoperitoneum, about half of those using it would continue for two or three years, and half for 4 to 5 years Interestingly enough, this is approximately the same time and the same percentage as those of the panel who would do pneumothorax felt that pneumothorax should be continued

Twenty three would use streptomycin, 18 of these combined with collapse Nearly all of the non-collapse group on the panel in this case would use streptomycin, grams $1\frac{1}{2}$ daily in divided doses

One physician advocates the use of the Barach chamber

Case VII Mrs E B This 28 year old colored married female had frequent "colds" and an almost continuous productive cough since an attack of pneumonia in September, 18 months ago She had casual contact with a sister who died of tuberculosis in 1942 On February 6th a chest x-ray revealed a mottled infiltration of miliary type throughout the entire right lung and a 4 cm hilar cavity with an area of infiltration extending along the border of the cardiac shadow toward the base on the left Sputum positive for tubercle bacilli

Discussion A large majority of the panel (49 to 8) favored collapse of some sort, 1 a left phrenic crush, 20 pneumothorax (14 left, 4 unspecified, 1 bilateral, and 1 left with a phrenic crush—side not specified) Pneumoperitoneum would be used by 28 (18 with a left phrenic) The majority of the panel who would use collapse therapy in this case would use pneumoperitoneum Eight only would wait as long as two to four months before starting collapse



Far advanced, bilateral pulmonary tuberculosis with mottling throughout right and large cavity in the left hilum in a female Negro age 28

The length of bed rest following collapse follows an irregular pattern with the large majority planning one to two years

Length of time of collapse would vary from two years to life, about one-half feeling three years would be adequate but nearly one-half recommending four to five years with both pneumothorax and pneumoperitoneum

Forty-nine would use streptomycin, in 41 combined with collapse

Four of the 8 who would not use collapse therapy hoped for the patient to improve under bed rest so that surgery could be done later and 2 of these felt that cavernostomies might be done, 1 a lobectomy and 1 a pneumonectomy All of the panel felt that this was a serious problem

Case VIII Mr I A This 34 year old male, shipyard worker, had occasional bilateral chest pains for 4 years when, following an appendectomy in January, he developed an ischo-rectal abscess On July 31, he was rejected by the Army because of a "tuberculous cavity" in the right upper lung On August 18, he had a small hemoptysis followed by fever for several days He visited a physician, and physical examination plus chest x-ray revealed only a 3 cm cavity at the right apex Sputum was positive for tubercle bacilli

Discussion The panel were unanimous in this case in favoring some type of collapse therapy One favored a phrenic, 37 pneumo-

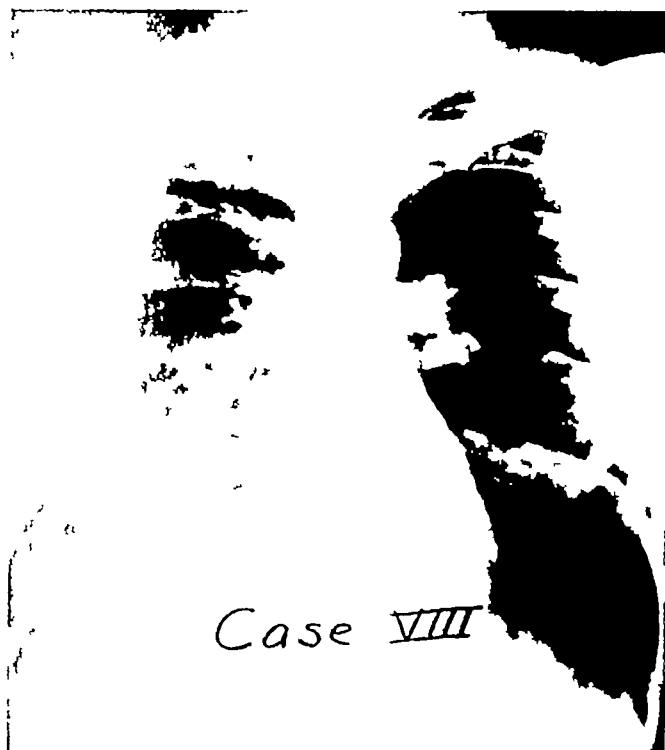
thorax (1 bilateral and 1 with a phrenic), 1 a pneumoperitoneum, and 18 thoracoplasty Nearly one-third favored thoracoplasty and the large majority would collapse early

Nearly two-thirds (27) would keep the patient in bed after collapse for six months or less and 18 for seven months to one and one-half years, with 11 inadequate answers The thoracoplasty group showed a wide divergence of opinion regarding time, as did the pneumothorax group Bed rest after thoracoplasty two to three months, 4, four to six months, 6, seven to eleven months, 2, while 5 would keep the patient in bed for from one to one and one-half years

The time of continuing the pneumothorax collapse showed a marked variation 9 recommended for two years, 12 for three years, 6 for four years, and 4 for five years

Streptomycin was only advocated 11 times 6 of these combined with thoracoplasty

There was more agreement to the answers in this particular case on choice of therapy and the time involved if the collapse became adequate The panel seemed also to be more sure of the expected results



Moderately advanced pulmonary tuberculosis, unilateral solitary 3 cm cavity, in a 34 year old white male

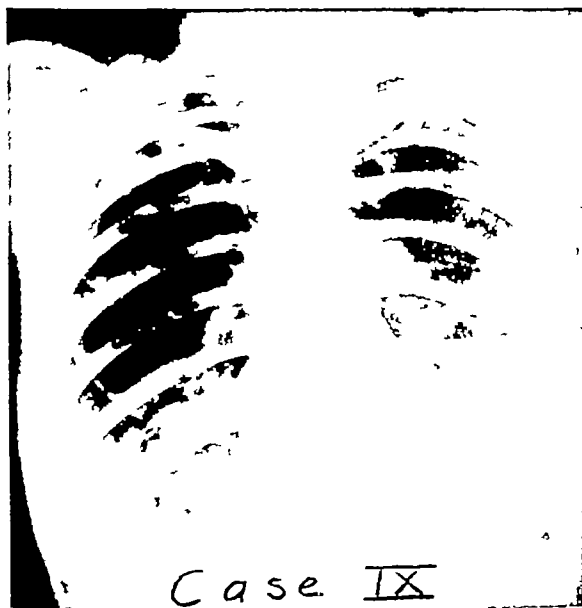
Case IX Mrs C W This 34 year old white married female felt well until she developed pain beneath the left scapula. She visited her physician at once, who found her intradermal tuberculin to be positive to 0.01 mgm O T A chest x-ray revealed a soft mottled infiltration in both upper lung fields, more extensive on the left. Sputum was positive for tubercle bacilli.

Discussion The panel was nearly equally divided as to whether collapse therapy should be used in this patient or not, 10 per cent more favoring no collapse therapy as the procedure of choice.

Regarding choice of collapse none wanted to do a phrenic, 6 would do a left pneumothorax, 10 bilateral pneumothorax, and 10 pneumoperitoneum, to which 2 would add a phrenic operation. The trend away from the use of phrenics is apparent as that procedure was not used by itself in the 57 answers. A little less than two-thirds of the panel favored pneumothorax, while more than one-third would use pneumoperitoneum.

Nearly one-third of the panel would wait a month to three months before starting collapse. The rest would start immediately. Nearly two-thirds felt that this patient should have seven to twenty-four months of bed rest together with these other procedures.

Regarding the duration of collapse therapy for pneumothorax two to four years about one-half stating three years, for pneumoperitoneum, the majority who would use that procedure said



Moderately advanced pulmonary tuberculosis acute more extensive on the left, in a 34 year old white female

four years but 3 of the panel would use it for a shorter time, approximating the time as noted for pneumothorax

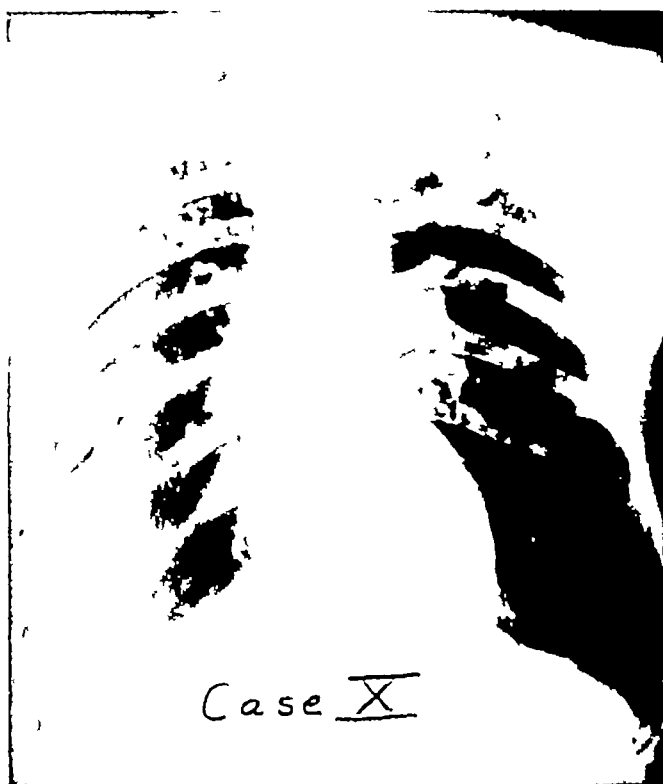
Streptomycin was recommended 21 times but only in 6 instances together with collapse Half of the group that would not use collapse therapy would rely on bed rest plus streptomycin for this patient

A large majority of the panel who would not use collapse would expect the patient to be in bed for from one to two years, but only approximately one-half the answers in this group were definite and the replies of the other one-half were inadequate

One physician advocates the use of the Barach pressure chamber

Case X Mr E H This 57 year old white American is a sales manager No family history of tuberculosis No known contacts

Past History Pneumonia at the age of 14, and again at the age of 21 Present Illness Two years ago the patient began to feel below par Prostatitis diagnosed and treated Last year diagnosed "heart trouble" X-ray of his chest finally taken, shows old calcified lesions at the right apex, multiple scattered nodules, little fibrosis, but soft infiltration throughout his right lung in the upper two-thirds Left lung shows a soft mottling throughout the upper one-third with a 1½ cm cavity in the first interspace Sputum was positive for tubercle bacilli Patient affable Very few chest symptoms No other medical problem



Far advanced pulmonary tuberculosis, fibro-caseous lesions in the upper half of both lungs with cavity left, in a 57 year old white male

Discussion The panel was equally divided in this patient as to whether to use collapse therapy or not. Of the group favoring collapse, 13 would use pneumothorax, of which 10 would do a left pneumothorax, 2 bilateral, and 1 with a left phrenic. Pneumoperitoneum would be used by 12 including 2 who would add a left phrenic operation. Left thoracoplasty would be done by 3. Those who would use pneumothorax and pneumoperitoneum as collapse therapy were equally divided.

Bed rest following collapse therapy, was advised by the panel for from two months to two years. More than one-third felt one year or more would be necessary.

They would continue collapse in pneumothorax for two to five years, about one-half recommending three years. With pneumoperitoneum, it was advised that collapse be continued for from three to five years but about one-half recommending only three years.

Streptomycin was recommended by 25 of the panel, 12 of whom would combine it with collapse therapy (approximately one-half).

Five of the group who would not use collapse therapy felt that bed rest could be used for less than one year. Eight of this group recommended for from one to three years, but 16 gave inadequate answers. There were only 9 such inadequate answers in the collapse group. Because of the patient's age and the character of the disease, in some instances it was definitely stated and in others the impression was given that many of this group would treat this patient as a custodial case rather than attempt procedures to make him sputum negative and control his lesions.

Discussion of Answers by Extent of Disease

Minimal The two minimal cases presented are rather too different to really compare one with the other (Cases I and III). The panel was about equally divided as to whether collapse should be used or not and nearly all agreed that when collapse was given it should be started early. The difference of opinion as to the seriousness of minimal disease is brought out in both cases, as is the lack of assurance as to how long to continue bed rest alone when collapse is not used. There is no real agreement as to how long to continue pneumothorax, but by far the majority settle on three years. There were very few phrenic operations advocated, only 7 out of 113 answers. Pneumothorax collapse was the common choice.

Moderately advanced In comparing the therapy of the moderately advanced cases (IV, V, VII, and IX), it is interesting to note that a phrenic alone was recommended only 6 times in 228 answers, pneumothorax was recommended 103 times, pneumo-

peritoneum 21, thoracoplasty 25 times in 228 total answers or in 177 answers by the group who would use collapse therapy

The panel showed great lack of agreement as to how long to keep the patient in bed following collapse. This varied from two months to two years. The majority would continue pneumothorax for three years, with a fair number favoring two years and four years about equally.

Far advanced With regard to the far advanced group (Cases II, VI, VII and X), the panel did not favor using a phrenic alone. Pneumoperitoneum was favored over pneumothorax 65 to 59. Nearly all those using collapse therapy would start the collapse rather promptly.

The amount of bed rest expected varied tremendously. With regard to the length of time to continue pneumothorax collapse, most of the panel favored three to four years, and pneumoperitoneum much the same with a few recommending pneumoperitoneum for five years.

Streptomycin received considerable use in this group.

Discussion of the Cases

Considering the group as a whole, the panel was about equally divided whether or not they would use collapse therapy in the following: For minimal disease, for bilateral, soft, moderately advanced lesions, for more fibrotic, moderately advanced disease, for one lung with evidence of tracheo-bronchitis, in older groups, for far advanced bilateral fibro-caseous disease. For pleural cavities they favored the use of collapse therapy. Note that the panel was unanimous in using collapse therapy in an apical cavity.

Those of the panel who favor collapse expect to have less bed rest and hence give more definite answers and fewer inadequate ones.

A majority favor three years for the continuance of pneumothorax collapse with the others varying from two to five years. The figures for pneumoperitoneum were very much the same.

Thoracoplasties are done very promptly by those that consider it the procedure of choice (in more than one-third immediately). The majority using the procedure would precede the thoracoplasty by one or two months of bed rest.

The panel would use a phrenic interruption as treatment in itself but rarely, limited practically to its occasional use in minimal disease.

Pneumoperitoneum would be used by the panel for moderately advanced bilateral exudative disease, for far advanced bilateral

acute cases, for far advanced disease in a Negro, as well as for far advanced bilateral fibro-caseous disease

Pneumothorax predominates by far as the collapse therapy of choice by the panel, except in moderately advanced bilateral acute disease and far advanced disease, where pneumoperitoneum was used equally or more frequently by the panel. In tuberculous pneumonia a large majority favored collapse with pneumothorax.

Streptomycin is being used for all sorts of lesions but less so for minimals, and to a lesser degree for moderately advanced unilateral fibrotic lesions, with or without cavitation. In these 10 cases, the men of the panel who would use collapse therapy would also use streptomycin 36 per cent of the time. Those of the panel who would in 9 of the cases not use collapse therapy would use streptomycin 46 per cent of the time. In 3 cases the "non-collapse" group would use streptomycin 3 times as frequently, in 2 cases twice as frequently, in 2 other cases definitely, in one case slightly more often, and in 1 case about the same as the figures for the collapse group. (One case had no "non-collapse" group). This shows that those who favored not using collapse therapy tended to rely more on streptomycin than did the group who favored collapse therapy. The "collapse" group did not tend to use streptomycin so often as an initial form of treatment.

In these 10 cases nearly all who used streptomycin would start the drug immediately and nothing statistically significant appeared in comparing individual cases, or by groups according to the extent of disease. About three-quarters would give a dose of one gm daily, usually in 2 divided doses—with the remaining one-quarter about equally divided into those giving $\frac{1}{2}$ gm in one daily dose and those giving $1\frac{1}{2}$ gm to 2 gm daily in divided doses.

There is a marked variation as to how long to continue the drug (from one to six months) but a very large majority favored six weeks to four months, with more (91) favoring three months than those favoring six weeks (46), two months (38), or four months (30). Thirty more favored three through six months as compared with those who favored one through two months.

A few interesting variations in the use of the drug were noted. Several start with 2 gm doses for four to seven days, and then reduce to 1.0 gm to $\frac{1}{2}$ gm doses. One advocates 1.0 gm divided in two doses every other day.

This represents the thinking of the panel as to their use of streptomycin as of approximately June 1, 1948.

Your Committee has been instructed by the Board of Regents of the College to extend this study during the year June 1948 to June 1949 by including selected groups from all of the Chapters

not included in the Continental limits of the United States with the advice and assistance of the Regents representing their respective countries

A second study on this same material will be done by having these cases presented and the questionnaires filled out by all those members of the college present at each of the Chapter meetings. This will give your Committee the opinions of a wide cross-section of the College membership, including many hundreds of replies. These replies may well lend themselves to additional analysis than those presented here.

A third study that has been requested on this material is its presentation at the end of each of the three postgraduate courses on Diseases of the Chest conducted during the current year under the auspices of the College. This will give a third cross-section of opinion for comparative study.

Submitted for the Committee by
Harold Guyon Trimble, M D

with the Technical assistance of
J Lloyd Eaton M D

Comment

The results of this preliminary survey on collapse therapy casts considerable doubt on the value of any collected statistics on the efficacy of such procedures. It is obvious that unless the indications for any given procedure are reasonably standardized and the management of this procedure during the course of the disease has likewise some uniformity, that the end results bear no relationship to each other and are practically impossible of correlation.

This is made particularly clear in this study. Had these been complicated cases, marked differences of opinion might be explained conceivably by the numerous variations and possible changes in the course of the disease. Had the panel been selected at random it might be said that there was too much variation in the experience of the men questioned. But in this study, the cases without exception were simple and uncomplicated, in fact, they represented the type of case which is used for demonstration and teaching to students. The panel, as can be seen by a reading of the names, is made up entirely of men of standing and experience in collapse therapy. We must therefore say that since these men had, with one or two exceptions, no significant points of agreement that the question of collapse therapy as well as the subjects of indications for bed rest and its duration, and the use of streptomycin, can hardly be said to be utilizable for scientific evaluation.

It is customary for scientific men to base their judgment on

clinical experience and statistical results of treated cases Is it possible that similar cases have varied so markedly in the hands of different men, or is it possible that some physicians are using prejudice and impressions in place of information There is, of course, the other possibility, and that is that uncomplicated tuberculosis does as well or as poorly, as the case may be, under any one of the recommended treatments

This was a study that was long needed and additional work along this line will be required before any of us will be in a position to make definite statements We are forced to wonder if instead of establishing study sections and large scale clinical studies on streptomycin, whether it might not have been very much more valuable to conduct a large scale study on the subjects of rest and collapse therapy Up to this moment, most of us believed that although differences of opinion existed, fundamental principles of treatment were agreed upon by all This study tells us how wrong we have been

Edwin R. Levine, M.D

Committee on the Management and
Treatment of Diseases of the Chest

Donato G. Alarcon, M.D., Mexico City, Mexico

Otto C. Brantigan, M.D., Baltimore, Maryland

Jose Ignacio Baldo, M.D., Caracas, Venezuela

Edward H. Robitzek, M.D., New York, New York

Edwin R. Levine, M.D., Chicago, Illinois, *Chairman*

Report on the Activities of the Council on Postgraduate Medical Education

The Council on Postgraduate Medical Education of the College has had a very active program in 1948. Postgraduate courses in diseases of the chest sponsored by the College Council have been presented this year in Philadelphia, San Francisco, Chicago and New York City.

The Philadelphia course, given March 15 through 20, in cooperation with the Laennec Society of Philadelphia, was highly successful with 62 physicians registered. The program of the course and the names of the physicians who attended were published in the March-April issue of the journal. The postgraduate course committee in Philadelphia, under the chairmanship of Dr. Chevalier L. Jackson, has announced that another course is being arranged in cooperation with the Laennec Society of Philadelphia for presentation the week of February 28, 1949.

The postgraduate course in San Francisco was presented September 13 through 17, in cooperation with the University of California Medical Extension and Stanford University School of Medicine. This course registered 43 physicians and was very well received. Dr. Stacy R. Mettler, Head of Postgraduate Instruction of the University of California Medical Extension, directed the course with the cooperation of Dr. Seymour M. Faiber, Secretary of the California Chapter of the College, and Dr. William L. Rogers, who served as chairman of the course. A recent letter received at the College Offices from Dr. Mettler has announced a postgraduate course for December 5 through 9, 1949, under similar conditions.

Following is a list of the physicians who attended the postgraduate course presented in San Francisco:

C. W. Anderson, M.D., Van Nuys, California
Ruth Anderson, M.D., Ventura, California
Lazlo S. Arany, M.D., Walla Walla, Washington
Lawrence E. Bach, Capt., M.C., U.S.N., Long Beach, California
Robert W. Baker, M.D., Livermore, California
W. S. Barclay, M.D., San Fernando, California
Parold Bunnbaum, M.D., San Fernando, California
Mary C. Block, M.D., F.C.C.P., Santa Ana, California
James M. Bodie, M.D., San Jose, California
Isabella M. Clinton, M.D., Auburn, California
Francis J. Curry, M.D., Ahwahnee, California
Walton M. Edwards, Major, M.C., U.S.A., San Francisco, Calif.
Peter J. Galante, M.D., F.C.C.P., Whipple, Arizona
Frank C. Gibson, M.D., Vancouver, Washington
Sophie L. Goldman, M.D., F.C.C.P., Bakersfield, California
James O. Greenwell, M.D., F.C.C.P., Redwood City, California
Robert M. C. Halbach, M.D., Stockton, California
Alden V. Holmes, Lt. (jg), M.C., U.S.N., Oakland, California
Raleigh M. Hood, Lt. (jg), M.C., U.S.N., San Diego, California
L. Sherman Jennings, M.D., San Francisco, California
Norman C. Johnson, M.D., Oroville, California
Marcel Kahn, M.D., Livermore, California
James R. Keeton, M.D., Lower Lake, California
William E. Larsen, Lt. (jg), M.C., U.S.N., Oakland, California
Joseph McGuinness, M.D., San Francisco, California
Isadore Mallin, M.D., Livermore, California
Solomon Netzer, M.D., F.C.C.P., San Fernando, California
Frank I. O'Neill, M.D., Oroville, California
Angela Piscitelli, M.D., F.C.C.P., San Francisco, California
C. B. Pramuk, M.D., Murphys, California

Edgar Risen, Capt, M C, U.S.N., (F C C P), Corona, California
 George O Roberts, M.D., McGill, Nevada
 Emanuel Rollins, Comdr, M C, U.S.N., Oakland, California
 John R Rupp, M.D., Ojai, California
 Findlay P Rutherford, M.D., F C C P, Santa Clara, California
 George D Saxton, F R C S (Ed), Vancouver, B C, Canada
 Adrian R M Sears, M.D., Biggs, California
 Wilfred L Shaw, M.D., Van Nuys, California
 Hans F Stein, M.D., Tucson, Arizona
 Robert H Stevens, M.D., Phoenix, Arizona
 J L Turner, M.D., Oakland, California
 John R Winston, M.D., Temple, Texas
 Anton Zikmund, Comdr, M C, U.S.N., Oakland, California

The Third Annual Postgraduate Course in Diseases of the Chest was presented in Chicago during the week of September 20. The course was enthusiastically received by the 44 physicians registered. Dr Edwin R Levine served as chairman of the postgraduate course committee and this committee plans to arrange a similar course in the fall of 1949 to be held in Chicago.

The following physicians attended the postgraduate course given in Chicago:

R. M. Anderson, M.D., F C C P, Hackensack, New Jersey
 Neil C Andrews, M.D., Columbus, Ohio
 Elmer A. Barron, M.D., Hines, Illinois
 Lt Col Wilbur C Berry, M C, U.S.A., San Francisco, California
 Col Albert A Biederman, M.C., U.S.A., Augusta, Georgia
 Bernard Breitner, M.D., Chicago, Illinois
 Paul J Breslich, M.D., F C C P, Minot, North Dakota
 William C Cunningham, M.D., Chicago, Illinois
 Daniel M Emerson, M.D., Springfield, Missouri
 S W Flemming, M.D., Jamestown, North Carolina
 Robert F Fultz, Lieut, M C, U.S.N., New York, New York
 Stanley M Gates, M.D., Little Rock, Arkansas
 Clifton Hall, M.D., F C C P, Springfield, Illinois
 J B Hall, M.D., Chicago, Illinois
 James L Hawley, M.D., Legion, Texas
 Aaron L Kaminsky, Maj, M C, U.S.A., Ft Sam Houston, Texas
 W F Kammer, M.D., Munice, Indiana
 Harold M Kramer, M.D., Louisville, Kentucky
 C L Libnoch, M.D., Marion, Illinois
 Samuel M Lobe, M.D., Cleveland, Ohio
 C D Lufkin, M.D., F C C P, Hot Springs, South Dakota
 James L May, M.D., Cleveland, Ohio
 Leo T Moleski, M.D., F C C P, Grand Rapids, Michigan
 George Nedherny, M.D., Chicago, Illinois
 Edward G Nedwicki, M.D., Dearborn, Michigan
 O C Nickum, M.D., Omaha, Nebraska
 Andres G Oliver, Col, M C, U.S.A., Keesler, Field, Mississippi
 Nell T Pattengale, M.D., Chicago, Illinois
 James C R Pen, M.D., Chengtu, China
 E T Peer, M.D., Hamilton, Ontario
 Samuel D Radin, M.D., Butler, Pennsylvania
 Alfred Rasmussen, M.D., Chicago, Illinois
 Lyman K Richardson, M.D., New Orleans, Louisiana
 Wyatt E Royce, M.D., F C C P, Richmond, Virginia
 Hyman J Schorr, M.D., Chicago, Illinois
 Joseph A Sciuto, M.D., F C C P, New Bedford, Massachusetts
 W W Scott, Col, M.C., U.S.A., Chanute Field, Illinois
 Carl Tempel, Col, M.C., U.S.A., (F C C P), Denver, Colorado
 H J Treshler, M.D., F C C P, Cresson, Pennsylvania
 Victor Y K Tyau, M.D., Shanghai, China

THIRD ANNUAL POSTGRADUATE COURSE IN DISEASES OF THE CHEST
September 20-25, 1948, Stevens Hotel, Chicago, Illinois



Some of the physicians and instructors who participated in the Third Annual Postgraduate Course in Diseases of the Chest of the American College of Chest Physicians

Herbert L. Walter, Lieut, M C, U.S.N., Charleston, South Carolina
 Charles E. Wiley, M.D., Waukesha, Wisconsin
 M. B. Winstead, Maj., M C, U.S.A., Washington, D. C.
 Marion T. Yates, Comdr, M C, U.S.N., Great Lakes, Illinois

The final postgraduate course for the year 1948 was presented in New York City, November 8 through 13, under the sponsorship of the Council and the New York State Chapter of the College with the cooperation of members of the staffs of the New York City Medical Schools and Hospitals. There were 76 physicians registered at this excellent course, which was arranged by Dr. Frank R. Ferlino, Secretary of the Council on Postgraduate Medical Education of the College, and Dr. Edgar Mayer, the chairman of the postgraduate course committee in New York.

The following physicians registered for the course

Sinclair T. Allen Jr., M.D., Burlington, Vermont
 M. Alton, M.D., Dublin, Ireland
 M. J. Antell, M.D., Bridgeport, Connecticut
 Carlos Antonetti, M.D., Havana, Cuba
 Silvio Rubens Barbosa da Cruz, M.D., Rio de Janeiro, Brazil
 J. A. Belz, M.D., Baltimore, Maryland
 John Biezuner, M.D., F.C.C.P., Hamilton, Ontario
 I. Bloom, M.D., New York, New York
 George D. Boone, M.D., Tucson, Arizona
 Judith Borenstein, M.D., Castle Point, New York
 R. W. Brand, M.D., Clifton Springs, New York
 Jorge Caceres, M.D., Lima, Peru
 Charles P. Cake, M.D., F.C.C.P., Washington, D. C.
 Harman E. Carr, Lt., M.C., U.S.N., Quonset Point, Rhode Island
 John F. Chace, Comdr, M.C., U.S.N., Newport, Rhode Island
 Henry P. Close, M.D., Coatesville, Pennsylvania
 P. R. Copeland, M.D., Huntington, West Virginia
 George M. Davis Jr., Comdr, M.C., U.S.N., Annapolis, Maryland
 William E. Denman Jr., M.D., Memphis, Tennessee
 Herbert R. Diaso, M.D., Syracuse, New York
 David E. Fader, M.D., Augusta, Georgia
 David H. Feinberg, M.D., F.C.C.P., Easton, Pennsylvania
 Anton Forsberg, M.D., Toronto, Ontario
 Ralph Friedlander, M.D., New York, New York
 Frank L. Geiger, M.D., Fort Jackson, South Carolina
 Andre Gelinas, M.D., F.C.C.P., St. Hyacinthe, Quebec
 Charles H. Gingles, Lt. Col., M.C., U.S.A., Washington, D. C.
 Roland Gluck, M.D., Brooklyn, New York
 Alfred G. Gillis, M.D., Lebanon, Pennsylvania
 Joseph Grandi, M.D., Easton, Pennsylvania
 P. W. Hardie, M.D., F.C.C.P., Hamilton, Ontario
 Frank T. Harrat, M.D., Frostburg, Maryland
 John G. Herzfeld, M.D., Nashville, Tennessee
 Frederic W. Holcomb, M.D., F.C.C.P., Kingston, New York
 Arthur G. Hollander, M.D., Atlanta, Georgia
 Christian K. C. Hoyle, M.D., Oteen, North Carolina
 Harry J. Hyer, M.D., Charlottesville, Virginia
 Stelio Z. Imprescia, M.D., Perry Point, Maryland
 Ralph C. John, M.D., Albany, New York
 C. Hege Kapp, M.D., Winston-Salem, North Carolina
 John F. Keithan, M.D., Asheville, North Carolina
 Maurice D. Kenler, M.D., F.C.C.P., New Bedford, Massachusetts
 Elmer A. Kleefeld, M.D., Forest Hills, New York
 Joseph Klugler, M.D., Northampton, Massachusetts
 J. A. Leaphart, M.D., Jesup, Georgia
 G. Emerson Learn, M.D., Mount Morris, New York
 David E. Liston, Col., M.C., U.S.A., (F.C.C.P.),
 Fort Totten, Long Island, New York

Willis A. Madden, M.D., Staten Island, New York
 Joseph M. Malin, M.D., Staten Island, New York
 Luke K. Malley, M.D., F.C.C.P., Dublin, Ireland
 Lemuel E. Mayo Jr., M.D., Portsmouth, Virginia
 Robert L. McCracken, M.D., F.C.C.P., Nashville, Tennessee
 Nathan T. Milliken, M.D., Hanover, New Hampshire
 Frank R. Moore, M.D., Athens, Ohio
 J. W. Moskowitz, M.D., Great Neck, New York
 Irvin L. V. Norman, Capt., M.C., U.S.N., Bethesda, Maryland
 Francis E. O'Brien, M.D., Haydenville, Massachusetts
 G. Leonard Oxley, M.D., Harrisburg, Pennsylvania
 Tarik Pachachi, M.D., Oneonta, New York
 George M. Powell, Col., M.C., U.S.A., Fort Dix, New Jersey
 Thomas J. Pekin, M.D., Washington, D.C.
 Joseph Pisaní, M.D., Bronx, New York
 John W. Raulston, Lt. Col. M.C. U.S.A., Washington, D.C.
 J. A. Redfearn, M.D., F.C.C.P., Albany, Georgia
 Harry H. Rosenthal, M.D., New York, New York
 Siegfried M. Schoenfeld, M.D., F.C.C.P., New Hyde Park, N.Y.
 Herbert F. Schwartz, M.D., F.C.C.P., Salisbury Center, New York
 Joseph A. Sciuto, M.D., F.C.C.P., New Bedford, Massachusetts
 Yetta Shevell, M.D., F.C.C.P., Otisville, New York
 Morris J. Small, M.D., Staten Island, New York
 Julius Solovay, M.D., Montgomery, Alabama
 Paul W. Spear, M.D., Brooklyn, New York
 Henry H. Stelman, M.D., F.C.C.P., Buffalo, New York
 Paul V. W. Waldo, M.D., Westhampton Beach, New York
 R. E. Whitehead, M.D., Ellis Island, New York
 George E. Wilson, M.D., F.C.C.P., Saranac Lake, New York

Dr. Richard H. Overholt, Brookline, Massachusetts, President of the American College of Chest Physicians lectured in all of the courses sponsored by the College this year. Dr. J. Winthrop Peabody, Washington, D.C., Chairman of the Council on Postgraduate Medical Education, attended the courses held in Philadelphia, Chicago and New York City, and assisted in the arrangements. All members of the College who gave so much of their time and talent for the success of these courses are to be congratulated for their excellent achievements and deserve the sincere thanks of the membership of the American College of Chest Physicians for their efforts.

The members of the Council on Postgraduate Medical Education are

J. Winthrop Peabody, M.D., Washington, D.C., Chairman
 Frank R. Ferlaino, M.D., New York, New York, Secretary
 Carl C. Aven, M.D., Atlanta, Georgia
 Seymour M. Farber, M.D., San Francisco, California
 Lorenz W. Frank, M.D., Denver, Colorado
 Edward Lebovitz, M.D., Pittsburgh, Pennsylvania
 Edwin R. Levine, M.D., Chicago, Illinois
 I. L. Robbins, M.D., New Orleans, Louisiana
 Maurice S. Segal, M.D., Boston, Massachusetts

College Chapter News

FLORIDA CHAPTER ORGANIZED

The members of the College in Miami and Miami Beach, Florida held a meeting at the Hotel Martinique, Miami Beach, on Thursday evening October 21, at which time it was decided to petition the Board of Regents of the College for a Charter to organize the Florida Chapter Dr M Jay Flipse; Miami, Governor of the College for Florida, appeared before the Board of Regents at their Semi-Annual meeting on October 23, at the Hotel Martinique, Miami Beach and the request for a Charter was granted Temporary officers for the new chapter were elected as follows

E C Brunner M.D , Miami, President

H K Edwards, M.D , Miami, Secretary-Treasurer

A Program Committee for the chapter was appointed by the President consisting of the following members

Nathaniel Levin, M.D , Miami, Chairman

Arnold S Anderson, M.D , St Petersburg

Alexander Libow, M.D , Miami Beach

ILLINOIS CHAPTER

The Illinois Chapter of the College sponsored a dinner and scientific session at the Congress Hotel, Chicago, on Friday evening, November 12 During dinner the Medical Education Committee discussed plans for the future programs of the chapter The scientific program presented was as follows

'Tumor Cells in Bronchial Secretions in Experimental Animals,"
Max Appel, M.D , Champaign, Illinois

'Cytological Diagnosis of Carcinoma of the Bronchus,"
Theodore T Bronk, M.D , Chicago, Illinois

Tumors of the Chest as Disclosed by Mass X-ray Survey,"
Dan Morse, M.D , F C C.P , Peoria, Illinois

The program terminated with an open discussion by the physicians in attendance

INDIANA CHAPTER

The Indiana Chapter of the College held a luncheon meeting on October 27 at the Murat Temple, Indianapolis, in conjunction with the meeting of the Tuberculosis Committee of the Indiana State Medical Association The following program was presented

A Resume of the Present Concept of Sarcoidosis,"
Robert G Bloch, M.D , Chicago, Illinois

A Summary of the Results of Streptomycin Therapy in Veterans Hospitals,"

Benjamin L Brock, M.D , F C C.P , Downey, Illinois

X-Ray Conference

MISSOURI CHAPTER

The Missouri Chapter of the College will hold a dinner meeting and scientific session at the Chase Hotel, St. Louis, on November 29, the day prior to the opening of the Interim Session of the American Medical Association in St. Louis. Dr. George Saslow, St. Louis, will be guest speaker at the dinner and his subject will be "Psychotherapy in the Treatment of Pulmonary Tuberculosis." A scientific program will be presented as follows:

"Suppurative Diseases of the Lungs,"

Minas Joannides, M.D., F.C.C.P., Chicago, Illinois

"The Effect of Bronchial Infection on Pulmonary Function,"

Edwin R. Levine, M.D., F.C.C.P., Chicago, Illinois

"Pulmonary Mobilization by Decortication,"

Tom H. Burford, M.D., St. Louis, Missouri

PENNSYLVANIA CHAPTER

The Pennsylvania Chapter of the College held its annual meeting at the Hotel Warwick, Philadelphia, on Monday, October 4. Dr. Hurley L. Motley, Associate Professor of Medicine, Jefferson Medical College, was guest speaker at a luncheon meeting. The title of Dr. Motley's excellent talk was "Pulmonary Studies in Respiratory Diseases." Following the luncheon a very interesting X-ray Conference was presented at which cases were presented by Drs. Theodos, Boucot, Bisbing, Szypulski and Ottenberg. The cases were discussed by experts including Drs. Chamberlain, Reimann and Johnson, and followed with general discussion by the physicians present.

A short business meeting was held in the afternoon at which time the following officers were elected for the coming year:

Edward Lebovitz, M.D., Pittsburgh, President

Membaud Judd, M.D., Hamburg, Vice-President

John V. Foster, M.D., Harrisburg, Secretary-Treasurer

The meeting closed with a dinner held at the Hotel Warwick that evening.

ROCKY MOUNTAIN CHAPTER

The annual meeting of the Rocky Mountain Chapter of the College was held on September 22 at Glenwood Springs, Colorado. The meeting was very well attended and great interest was shown in the excellent scientific program presented, as published in the September-October issue of the journal. The following officers of the chapter were elected for the coming year:

Ralph G. Rigby, M.D., Salt Lake City, Utah, President

Fred R. Harper, M.D., Denver, Colorado, Vice-President

W. Bernard Yegge, M.D., Denver, Colorado, Secretary-Treasurer

SOUTHERN CHAPTER

The Southern Chapter of the College held its Sixth Annual meeting in Miami Beach and Miami, Florida, on October 24 and 25, in conjunction with the annual meeting of the Southern Medical Association. The luncheon and annual banquet were very well attended and the scientific

program presented, as published in the September-October issue of the journal, drew a large audience

At the business meeting of the chapter the following officers were elected for the ensuing year

Dean B Cole, M.D , Richmond, Virginia, President
David H Waterman, M.D Knoxville, Tenn , 1st Vice-President
M Jay Flipse, M.D , Miami, Florida, 2nd Vice-President
Hollis E Johnson, M.D , Nashville, Tenn , Secretary-Treasurer

CUBAN CHAPTER

On Tuesday, October 26, following the meeting of the Southern Chapter, a group of College members and their wives went to Havana, Cuba to attend a special meeting of the Cuban Chapter that evening A reception committee, comprised of Drs Rene G Mendoza, Gustavo Alde-regula, Jose G Arrazuria and Antonio Navarrete, of Havana, met the group at the airport and facilitated the customs and immigration procedures for the visiting physicians from the United States

An excellent scientific program was presented that evening at the Scientific Academy in Havana, as published in the September-October issue of *Diseases of the Chest* Dr Rene G Mendoza, Havana, Vice-President of the Cuban Chapter and Chairman of the Program Committee for the meeting, opened the session with a welcoming speech to the members from the United States Dr Louis Mark, Columbus, Ohio First Vice-President of the College, responded and expressed the pleasure of the visiting physicians in attending the meeting and thanked the Cuban Chapter for their kind hospitality

The Cuban Chapter gave a cocktail party and dinner for the visiting physicians and their wives on the following evening, October 27 Dr Cruz Menoz, Havana, President of the Cuban Medical Society, presented a talk at the dinner welcoming the delegation from the United States Dr Edgar Davis, Washington, D C, gave a brief talk in response to Dr Menoz and expressed the delegation's appreciation of the cordial reception given them

VIRGINIA CHAPTER

The Virginia Chapter of the College held a luncheon meeting at the John Marshall Hotel, Richmond, on October 19, in connection with the annual meeting of the Virginia State Medical Society Walter L Nalls, M.D F.C.C.P., Alexandria, gave a very interesting talk on "Pneumoperitoneum in the Treatment of Tuberculosis" This was followed by active discussion on the part of the members and visitors present Dr Dean B Cole M.D , Richmond, President of the Chapter, presided and introduced Dr J Winthrop Peabody, Washington, D C, Past-President and Chairman of the Council on Postgraduate Medical Education of the College, who was a guest at the meeting Dr Peabody gave a brief talk on the activities of the College

WISCONSIN CHAPTER

The Fourth Annual Meeting of the Wisconsin Chapter was held at the Schroeder Hotel, Milwaukee, and was attended by approximately 300 physicians. The program presented at the meeting was published in the September-October issue of the College journal. The following officers of the chapter were elected for the coming year:

George H. Jurgens, M.D., Milwaukee, President
 John K. Shumate, M.D., Madison, Vice-President
 Leon H. Hirsh, M.D., Milwaukee, Secretary-Treasurer

The Speakers Bureau of the Wisconsin Chapter has supplied the following speakers for meetings of the county medical societies:

Vernon County Medical Society

"Modern Treatment of Cough"

Andrew L. Banyai, M.D., F.C.C.P., Milwaukee

"Differential Diagnosis of Diseases of the Chest,"

Leon H. Hirsh, M.D., F.C.C.P., Milwaukee

Eau Claire, Dunn and Pepin Counties Medical Society

"Cystic Disease of the Lung,"

George H. Jurgens, M.D., F.C.C.P., Milwaukee

"Bronchogenic Carcinoma,"

Mischa Lustok, M.D., F.C.C.P., Milwaukee

Washington and Ozaukee County Medical Societies

"Differential Diagnosis of Diseases of the Chest"

Leon H. Hirsh, M.D., F.C.C.P., Milwaukee

ORGANIZATIONAL MEETING, URUGUAYAN CHAPTER

Montevideo, Uruguay, July 21, 1948



Sitting, left to right: Drs. Pintos, Jackson, Ugon, Silveira (Brazil), Gomez and Sarno. Background: Drs. Blanco, LeBorgne, Cardozo, Sicardi, Pittaluga, Negro, Caubarrere, Capurro, Araus, Barani and Burgos.

College News Notes

David Salkin, M.D., F.C.C.P., formerly Superintendent of Hopemont Sanitarium, Hopemont, West Virginia, has accepted the position as Chief of Professional Services (Clinical Director), Veterans Administration Hospital, San Fernando, California

A L Starkey, M.D., F.C.C.P., who for many years has served as assistant superintendent of the Hopemont Sanitarium, has been named acting superintendent to succeed Dr David Salkin

Donato G Alarcon, M.D., F.C.C.P., Mexico City, Mexico, presented a paper entitled "Ten Years of Extrapleural Pneumothorax—Discussion of the Technique and Results," at the 38th Annual Meeting of the Texas Tuberculosis Association held in San Angelo, Texas, September 24-25

Robert J Anderson, M.D., has been appointed as medical director and chief of the Tuberculosis Division of the U S Public Health Service. He succeeds Francis J Weber, M.D., F.C.C.P., who has been assigned to postgraduate work in psychiatry at Johns Hopkins University. Dr Anderson was formerly assistant chief of the division

The Ohio State Medical Association sponsored a postgraduate course on new advances in the diagnosis and treatment of chest diseases, October 21, in Chillicothe. Drs John H Skavlem, W L Potts, D W Heusinkveld, Joseph B Stocklen, Maurice G Buckles and Sidney E Wolpaw, Fellows of the American College of Chest Physicians, lectured in the course

Hugh L Houston, M.D., F.C.C.P., Murray, Kentucky, has been elected President-Elect of the Kentucky State Medical Association

Walter E Vest, M.D., F.C.C.P., Huntington, West Virginia, editor of the West Virginia Medical Journal, has been re-elected by the Board of Trustees of the American Medical Association as a member of the advisory committee of the Cooperative Medical Advertising Bureau

NEWLY APPOINTED REGENTS AND GOVERNORS OF THE COLLEGE

Regents

India Raman Viswanathan, M.D.

New Delhi

South Africa David P Marais, M.D.

Cape Town

Governors

Nebraska Max Fleishman, M.D.

Omaha

U S Indian Service Arthur W Dahlstrom, M.D.

Rapid City, S D

England Peter W Edwards, M.D.

Shropshire

India Prag Nath Kapur, M.D.

Delhi

Korea In Sung Kwak, M.D.

Seoul

South Africa

North P J Kloppers, M.D.

Pretoria

South Theodore Schrire, M.D.

Cape Town

ULAST MEETING IN MEXICO CITY

The Union of Latin American Tuberculosis Societies (ULAST) will hold its Eighth Congress in Mexico City, January 23-29, 1949. A special session of the Mexican Chapter of the College will be held in which a number of papers will be presented by its members as well as by members from the United States of America. The following physicians will participate in the special session of the Mexican Chapter:

"Importancia Clinica del Bronquio Segmental y Su Correspondiente Segmento Bronco-Pulmonar,"

Chevalier L. Jackson, M.D., Philadelphia, Pennsylvania

"A Serious Silent Lesion, Its Rational Management,"

Richard H. Overholt, M.D., Brookline, Massachusetts

"Tuberculosis and Hospital Personnel,"

Jay Arthur Myers, M.D., Minneapolis, Minnesota

"A Pathologic Investigation on Tuberculous Pleuritis"

Henry C. Sweany, M.D., Chicago, Illinois and

Jose Gomez, M.D., Buenos Aires, Argentina

"The Treatment of the Residual Cavities after Thoracoplasty by Lucite Packing"

Frank S. Dolley, M.D., Los Angeles, California

"The Relation of Chronic Bronchial Infection to the Impairment of Pulmonary Function,"

Edwin R. Levine, M.D., Chicago, Illinois

"Co-Existent Pulmonary Tuberculosis and Bronchogenic Carcinoma"

Seymour M. Farber, M.D., San Francisco, California

"Recent Developments in the Conservative Treatment of the Giant Cavity,"

Donato G. Alarcon, M.D., Mexico City

The scientific sessions will be held at the Instituto de Cardiologia in Mexico City. A breakfast meeting of all of the Regents and Governors of the College in the Latin American countries will be held during the Congress. The program of the Council on Pan American Affairs of the College will be discussed at this meeting with Dr. Chevalier L. Jackson, Chairman presiding. It is also planned to have a luncheon meeting at the time of the Congress to which all members of the College in attendance will be invited.

The Officers of the Eighth Congress of the Union of Latin American Tuberculosis Societies are: Dr. Ismael Cosío Villegas, President, Drs. Miguel Jimenez and Donato G. Alarcon, Vice-Presidents, Dr. Fernando Gomez, Perpetual Secretary, Dr. Fernando Rebora, General Secretary, Dr. Manuel Alonso, Secretary of the Exterior, Dr. Carlos Noble, Secretary of the Interior, Dr. Rafael Ibarra, Acting Secretary of the Sessions, Dr. Carlos Díez Fernandez, Secretary of Publications, and Dr. Fernando Katz, Treasurer.

THIRD NATIONAL CONGRESS OF TUBERCULOSIS AND SILICOSIS

The Third National Congress of Tuberculosis and Silicosis will take place during the last week of January, 1949, in Mexico City, in conjunction with the Eighth Congress of ULAST. The officers of the Third National Congress of Tuberculosis and Silicosis have extended an invitation to the members of the American College of Chest Physicians to

attend their meeting The officers of this society are Dr Alejandro Celis, President, Dr Emilio Esquivel, Secretary, and Dr Manuel Alonso Treasurer

The program and activities to be presented by the Union of Latin American Tuberculosis Societies and the Congress of Tuberculosis and Silicosis, will be of interest to all chest specialists and it is hoped that many College members in North, Central and South America will attend these meetings The Executive Offices of the College in Chicago will be pleased to assist members in making their hotel reservations and other arrangements

NEW YORK STATE CREATES MEDICAL ADVISORY BOARD TO THE NEW YORK STATE BOXING COMMITTEE

Recently several deaths have occurred in boxing and wrestling In an effort to make these sports less hazardous, New York State has enacted a law creating a Medical Advisory Board to the New York State Boxing Commission New standards and regulations for the pre- and post-bout examinations of boxers and wrestlers will be formulated by the Medical Advisory Board and will be put into effect by the Boxing Commission in an effort to safeguard the health of boxers and wrestlers

Governor Dewey appointed Frank R Ferlino, M.D, F C C P Brooklyn, New York, as chairman of the nine-physician board

COURSE IN PHYSIOLOGIC THERAPY IN BRONCHO-PULMONARY DISEASES

Columbia University announces a course, "Physiologic Therapy in Broncho-Pulmonary Diseases" (Medicine PM 1), Monday through Friday January 24-29, 1949, offered by Drs Alvan L Barach, F C C P, H A Bickerman and C Eastlake The course will deal with the principles of physiologic and antibiotic therapy of bronchial asthma, pulmonary emphysema and fibrosis, chronic bronchitis and bronchiectasis, and pulmonary tuberculosis The application of techniques will be demonstrated on cases receiving inhalational, aerosol and immobilizing lung chamber therapy The fee will be \$40 00 and is part of the program available for veterans under the G I Bill of Rights

AMERICAN DIABETES ASSOCIATION LAUNCHES CAMPAIGN

The American Diabetes Association is launching a nation-wide drive of diabetes detection and Dr Howard Root of Boston is Chairman of the committee appointed to carry on with this work The inauguration of a year-round Diabetes Detection Drive will be National Diabetes Week, December 6 to 12, 1948 College chapters are urged to include material on diabetes detection in their programs The discovery and treatment of diabetes mellitus at an early stage demands the attention of all practicing physicians Failure to discover and treat diabetes early, results in preventable disabilities and impairments of health

Obituaries

CLEMENTE FERREIRA

1857 - 1947

Dr Clemente Ferreira died on August 6, 1947, at the age of 90. He pioneered a program for the control of tuberculosis in the state of Sao Paulo, Brazil and established several dispensaries at the beginning of this century, introducing pneumothorax in that state. He wrote a great number of papers both medical and for the layman. In 1880 he wrote his thesis on pulmonary tuberculosis. Just a few days before his death, Dr Ferreira wrote a paper on "Diazone and Streptomycin."

The control of tuberculosis in Sao Paulo was planned and supervised by Dr Ferreira. The "Ferreira League" which is the anti-tuberculosis league of the state of Sao Paulo was named after him. Dr Ferreira belonged to many medical societies, among them the International Union Against Tuberculosis and the Union of Latin American Tuberculosis Societies.

Dr Ferreira was revered by all of his countrymen and his memory will long remain in the hearts of his friends.

LLOYD H PATTERSON

1910 - 1948

It is with deep regret that we announce the death of Dr Lloyd H Patterson, Tuberculosis Physician at the Veterans Administration Hospital, San Fernando, California.

Dr Patterson passed away at St Vincent Hospital, Los Angeles, on April 5, 1948. He was born in Holland, Michigan on May 18, 1910. He received his degree in Medicine at the University of Southern California in 1937, served his internship at Orange County Hospital, Santa Ana, California, and had one year of postgraduate work at Mercy Hospital, New Orleans, Louisiana. Following this he was employed as Chief Resident Physician at Stonybrook Retreat, Keene, California, for five years and for the past year and a half has been with the Veterans Administration.

Dr Patterson's wife and two small children survive. The entire staff will feel his loss, for he was respected and admired for his ability as a physician and his kindly attitude toward his patients.

Roy A Wolford, M.D., Governor for
the Veterans Administration

BERTHOLD STEINBACH POLLAK

1873 - 1948

Dr Berthold S Pollak was born in Vienna, Austria on June 26, 1873 and died in Jersey City, New Jersey on June 27, 1948. After a preliminary education in Vienna, he came to the United States in 1888, and was employed for a time at the wholesale drug firm of Bullock & Crenshaw in Philadelphia. Later he entered the Philadelphia College of Pharmacy,

and in 1891 entered the University of Pennsylvania. In 1895 he transferred to Dartmouth College and graduated the same year. He was licensed to practice medicine in New Jersey in 1898.

Dr Pollak was first associated with his uncle, Dr Lewis Steinbach, Professor of Surgery at the Philadelphia Polyclinic Hospital, and then became chief resident at the Pottsville Hospital, Pottsville, Pennsylvania. He moved to Jersey City in 1899 and entered private practice. Dr Pollak was made the medical director of the Hudson County Tuberculosis Hospital and Sanatorium on February 1, 1907, and in October, 1946 the hospital was renamed in his honor. He was also Medical Director of the Hudson County Tuberculosis Clinics located in various cities of that county.

He was charter member and organizer of the Hudson County Tuberculosis League and also helped organize the New Jersey Tuberculosis League and served as president in 1923-1924. Dr Pollak was a director of the National Tuberculosis Association, a member of the International Union Against Tuberculosis and was a delegate at the conferences of the latter organization in London, Paris, Lausanne, Brussels, Oslo and Warsaw. He was appointed by President Coolidge to represent the United States at the International Conference in Rome.

Dr Pollak was a member of a number of medical societies and was a Fellow of the American College of Chest Physicians. At the time of his death, he was vice-president of the New Jersey Chapter of the College. Dr Pollak made many contributions to the medical literature.

New Jersey has lost one of its outstanding figures in the field of diseases of the chest. His memory will be cherished by his many friends.

Irving Willner, M.D., Governor for New Jersey

VERA V NORTON

1877 - 1948

Dr Vera V Norton died at St Joseph's Mercy Hospital, Waverly, Iowa on August 11, 1948. She attended Northwestern University Medical School and received the degree of Doctor of Medicine in 1899. Following this she interned at Wesley Hospital, Chicago, Illinois for a year. She then entered general practice in Waverly, where she remained until 1912.

In 1913 she joined the staff of the Edward Sanatorium in Naperville, Illinois, where she remained for four years. Following this she became associated with the Hamilton County Tuberculosis Sanatorium, now the Dunham Hospital, in Cincinnati, Ohio. During the latter part of her career at Cincinnati she was Associate Medical Director of the Sanatorium. She practiced here until her retirement in 1941.

She was a Fellow of the American College of Chest Physicians and a member of the American Trudeau Society, Northwestern University Alumni Association and American Association of University Women. Since retirement, she has been a member of the Bremer County Medical Society and Iowa State Medical Society.

Dr Norton practiced her profession with distinction and won the respect and love of all who were associated with her.

J Carl Painter, M.D., Governor for Iowa

DISEASES OF THE CHEST

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